Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults (Review)

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This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2010, Issue 9

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[Intervention Review]

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Editorial group: Cochrane Bone, Joint and Muscle Trauma Group.
Publication status and date: New search for studies and content updated (conclusions changed), published in Issue 9, 2010.
Review content assessed as up-to-date: 7 July 2010.

Citation: Parker MJ, Handoll HHG. Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults. *Cochrane Database of Systematic Reviews* 2010, Issue 9. Art. No.: CD000093. DOI: 10.1002/14651858.CD000093.pub5.

ABSTRACT

Background

Two types of implants used for the surgical fixation of extracapsular hip fractures are cephalocondylic intramedullary nails, which are inserted into the femoral canal proximally to distally across the fracture, and extramedullary implants (e.g. the sliding hip screw).

Objectives

To compare cephalocondylic intramedullary nails with extramedullary implants for extracapsular hip fractures in adults.

Search strategy

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (April 2010), The Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2010, Issue 1), MEDLINE (1950 to March 2010), EMBASE (1980 to 2010 Week 13), and other sources.

Selection criteria

All randomised and quasi-randomised controlled trials comparing cephalocondylic nails with extramedullary implants for extracapsular hip fractures.

Data collection and analysis

Both authors independently assessed trial quality and extracted data. Wherever appropriate, results were pooled.

Main results

We included 43 trials containing predominantly older people with mainly trochanteric fractures.

Twenty-two trials (3749 participants) compared the Gamma nail with the sliding hip screw (SHS). The Gamma nail was associated with increased risk of operative and later fracture of the femur and increased reoperation rate. There were no major differences between implants in wound infection, mortality or medical complications.

Five trials (623 participants) compared the intramedullary hip screw (IMHS) with the SHS. Fracture fixation complications were more common in the IMHS group. Results for post-operative complications, mortality and functional outcomes were similar in both groups.

Three trials (394 participants) showed no difference in fracture fixation complications, reoperation, wound infection and length of hospital stay for proximal femoral nail (PFN) versus the SHS.

None of the 10 trials (1491 participants) of other nail versus extramedullary implant comparisons for trochanteric fractures provided sufficient evidence to establish definite differences between the implants under test.

Two trials (65 participants) found intramedullary nails were associated with fewer fracture fixation complications than fixed nail plates for unstable fractures at the level of the lesser trochanter.

Two trials (124 participants) found a tendency to less fracture healing complications with the intramedullary nails compared with fixed nail plates for subtrochanteric fractures.

Authors' conclusions

With its lower complication rate in comparison with intramedullary nails, and absence of functional outcome data to the contrary, the SHS appears superior for trochanteric fractures. Further studies are required to confirm whether more recently developed designs of intramedullary nail avoid the complications of previous nails. Intramedullary nails may have advantages over fixed angle plates for subtrochanteric and some unstable trochanteric fractures, but further studies are required.

PLAIN LANGUAGE SUMMARY

Cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Fractures of the thigh bone (femur) just below the hip joint capsule (extracapsular hip fractures) may be surgically fixed using a variety of implants. One particular type of implant is the sliding hip screw, which consists of a screw that is inserted into the upper part of the (femur) to bridge (fix) the fracture. This screw can move within a metal barrel connected to a plate that is screwed to the outside of the femur. Implants of this sort of design are called 'extramedullary'. Intramedullary implants are nails inserted from the top of the femur into the inner cavity of the femur bone ('the medulla') and held in place with screws. This review compared these two types of implants in predominantly older populations.

The main results were for the comparisons of various types of intramedullary nails with the sliding hip screw. Twenty-two trials, involving 3749 participants, tested the Gamma nail. Five trials, involving 623 participants, tested the intramedullary hip screw (IMHS). Three trials, involving 394 participants, tested the proximal femoral nail. Other trials involved newer varieties of intramedullary nails. Most older trials showed a tendency for the nails to be associated with an increased risk of fracture of the thigh bone both during and after the operation. More recent trials testing newer varieties of nails seemed to avoid this specific problem to some extent. The review found that using intramedullary nails resulted in one extra reoperation in every 50 people. Mortality and, where data were available, other long-term outcomes were similar between the implants.

The review concluded that current evidence supports the continued use of the sliding hip screw for fixing the more common types of extracapsular hip fractures. This may not be the case for some of the more recently developed designs of intramedullary nails or for specific fracture types, but further research is required to confirm this.

BACKGROUND

Description of the condition

Hip fracture is the general term for fracture of the proximal (upper) femur. These fractures can be subdivided into intracapsular fractures (those occurring within or proximal to the attachment of the hip joint capsule to the femur) and extracapsular (those occurring outside or distal to the hip joint capsule). Extracapsular hip fractures are defined as those fractures of the proximal femur within the area of bone from the attachment of the hip joint capsule to a level of five centimetres below the distal (lower) border of the lesser trochanter. Other terms used to describe these fractures include trochanteric, subtrochanteric, pertrochanteric and intertrochanteric fractures. As implied above, these terms reflect the proximity of these fractures to the greater and lesser trochanters (Parker 2002).

Numerous subdivisions and classification methods exist for these fractures. The most practical classification, and that used for this review, is the basic division into four types: stable trochanteric fractures (AO classification type A1) (Muller 1991), unstable trochanteric (AO classification type A2), those fractures at the level of the lesser trochanter (transtrochanteric or AO classification type A3) and subtrochanteric fractures. Stable trochanteric fractures are two part fractures in which the fracture line runs obliquely between the lesser and greater trochanter of the femur. Unstable trochanteric fractures again have an oblique fracture line running between the trochanters but in addition there is comminution of the fracture site. The comminution fragments may be the lesser trochanter, greater trochanter or both these parts of the femur. Those fractures at the level of the lesser trochanter (AO A3, transtrochanteric) have a slightly more distally based fracture line which either runs transversely at the level of the lesser trochanter or in an oblique direction that is opposite to that of the stable and unstable trochanteric fractures. These fractures may be two part or comminuted. This fracture pattern allows the femur to be displaced medially due to the pull of the abductor muscles. Subtrochanteric fractures are those fractures in which the fracture crossing the femur is predominately found within the five centimetres of bone immediately below the lesser trochanter. These fractures may be two part or comminuted and, in some instances, the fracture may extend proximally into the trochanteric region or distally into the shaft of the femur.

Description of the intervention

Operative treatment of extracapsular hip fractures was introduced in the 1950s using a variety of different implants. Implants may be either extramedullary or intramedullary in nature. The most commonly used extramedullary implant is the sliding hip screw (SHS) which is synonymous with the term compression hip screw and equivalent models such as the Dynamic, Richards or Ambi hip screws. The SHS consists of a lag screw passed up the femoral neck to the femoral head. This lag screw is then attached to a plate on the side of the femur. These are considered 'dynamic' implants as they have the capacity for sliding at the plate/screw junction to allow for collapse at the fracture site. The Medoff plate (Medoff 1991) is a modification of the sliding hip screw. The difference is that the plate has an inner and outer sleeve, which can slide between each other. This creates an additional capacity for sliding to occur at the level of the lesser trochanter as well as at the lag screw. Sliding at the lag screw can be prevented with a locking screw to create a 'one way' sliding Medoff instead of a 'two way' sliding Medoff. At a later date the locking device on the lag screw can be removed to 'dynamise' the fracture.

Static implants include the fixed nail plates such as the Jewett and the McLaughlin nail plates. The 90 or 95-degree blade plate is also a static implant of a more recent design. Though, theoretically, the dynamic condylar screw plate has the capacity for sliding at the screw plate junction, it is more likely to act as a fixed device when used at the hip, with no slide occurring.

Intramedullary nails used for internal fixation of extracapsular fractures can either be inserted from distal to proximal (condylocephalic nails) or from proximal to distal (cephalocondylic nails). Condylocephalic nails are inserted at the level of the femoral condyle above the knee and passed across the trochanteric fracture and up into the femoral head. These are the subject of another review (Parker 1998). Cephalocondylic nails are inserted through the greater trochanter of the femur and secured by a cross pin or screw which is passed up the femoral neck into the femoral head. Theoretical biomechanical advantages of these intramedullary nails over screw and plate fixation are attributed to a reduced distance between the hip joint and the implant, which diminishes the bending moment across the implant/fracture construct. Examples of these intramedullary nails are the Gamma nail, the intramedullary hip screw (IMHS), the proximal femoral nail (PFN), the proximal femoral nail antirotation (PFNA), the Targon PF (proximal femoral) nail, the Holland nail and the Kuntscher-Y nail (Cuthbert 1976). These nails plus an experimental nail tested in Dujardin 2001 are described in Table 1. A review comparing different intramedullary nails for these fractures is available (Parker 2006).

Table 1. Intramedullary nails evaluated by the included trials

Name	Description
Gamma nail	The Gamma nail (Howmedica Ltd) was introduced in the late 1980s for the treatment of extracapsular hip fractures. The implant consists of a sliding lag screw which passes through a short intramedullary nail. One or two screws may be passed through the nail tip to secure it to the femoral shaft (distal locking). Theoretical advantages of this implant are due to a percutaneous insertion technique and include reduced blood loss, reduced sepsis, minimal tissue trauma and short operating time. Modifications to the design of the Gamma nail and its instrumentation have occurred since its introduction. The trochanteric Gamma nail is referred to as a third generation Gamma nail. It is shorter in length than the standard Gamma nail (200 mm versus 180 mm), has a lower mediolateral curvature (4 degrees) and has a diameter of 17 mm proximally and 11 mm distally. The long Gamma nail has a range of different lengths from 280 to 460 mm with two distal locking screws.
Intramedullary hip screw (IMHS)	The IMHS (Richards Medical Ltd) - length 210 mm - was introduced in 1995 for the treatment of extracapsular femoral fractures. Like the Gamma nail, it consists of a nail inserted via the greater trochanter into the medullary cavity and a lag screw, which is passed up the femoral neck to the head.
Proximal femoral nail (PFN)	The PFN (Synthes Ltd) - length 240 mm - was introduced in 1998 for the treatment of extracapsular fractures. Like the Gamma and IMHS, it consists of a nail inserted via the greater trochanter in to the medullary cavity. Two proximal lag screws are passed up the femoral neck to the head.
Proximal femoral nail antirotation (PFNA)	The PFNA (Synthes Ltd) - length 170, 200 or 240 mm - is similar to the PFN nail apart from not having two proximal lag screws but instead a single helically-shaped blade.
Targon PF (proximal femoral) nail	The Targon PF nail - length 220 mm - is also inserted in a similar fashion into the intramedullary cavity. Proximally, this nail has a sliding lag screw and an antirotation pin.
Holland nail	The Holland nail (Biomet ltd) is like the Gamma and IMHS; it consists of a nail inserted via the greater trochanter in to the medullary cavity. Two proximal lag screws are passed up the femoral neck to the head.
Experimental nail (reported in Dujardin 2001)	An experimental mini-invasive static intramedullary nail, which is not commercially available, is reported in Dujardin 2001. This consists of an intramedullary nail which is 170 millimetres long with a distal diameter of 12 millimetres and a proximal diameter of 13 millimetres. There are two five millimetre distal locking holes. The proximal hold of the femur is with two seven millimetre cannulated screws which diverge at a 30 degrees angle. Unlike the other proximal femoral nails, there is no sliding mechanism within the nail construct.
Kuntscher-Y nail	The Kuntscher-Y nail (Cuthbert 1976) is an early design of an intramedullary nail. It consists of a side arm and a separate slotted Kuntscher nail. The side arm is passed up the femoral neck, and then attached to an alignment jig to enable a slotted

Table 1. Intramedullary nails evaluated by the included trials *(Continued)*

	Kuntscher nail to be passed via the greater trochanter through a hole in the side arm and distally within the medullary cavity. The assembled implant construct has no capacity for sliding at the side arm and neither has it the capacity for distal locking.

Why it is important to do this review

The controversy over the choice of implant, specifically the use of intramedullary nails versus sliding hip screws, for extracapsular hip fractures continues. Indeed, recent studies reporting a rapid increase in the use of intramedullary nails in the USA have pointed out, citing this review, that this phenomenon is not supported by the available evidence (Anglen 2008; Forte 2008). The availability of new evidence, often on new implants that are aimed at avoiding the complications, specifically operative and later femoral fracture, of intramedullary fixation, point to the need for this update of our review, which continues to compare different types of cephalocondylic nails with extramedullary implants.

OBJECTIVES

To assess the relative effects of cephalocondylic intramedullary nails versus extramedullary fixation implants for treating extracapsular proximal femoral (hip) fractures in adults. Effects were assessed in terms of 'operative details' (duration of surgery, exposure to ionising radiation, blood loss); 'fracture fixation complications', including wound infection; 'post-operative complications' and length of hospital stay; 'anatomical restoration'; and 'final outcome measures' (mortality, functional outcome and pain).

METHODS

Criteria for considering studies for this review

Types of studies

uAll randomised or quasi-randomised (e.g. alternation) controlled trials comparing any design of cephalocondylic intramedullary nail with any design of extramedullary fixation implant.

Types of participants

Skeletally mature adults with an extracapsular proximal femoral fracture (trochanteric or subtrochanteric), whether stable or unstable.

Types of interventions

Surgical fixation of the fracture with a cephalocondylic intramedullary nail compared with using an extramedullary implant.

Types of outcome measures

The following outcomes were sought.

1. Operative details
    - length of surgery (in minutes)
    - operative blood loss (in millilitres)
    - number of patients transfused
    - radiographic screening time (in seconds or minutes)

2. Fracture fixation complications
    - operative fracture of the femur (around or below the implant, but excluding comminution of the fracture site)
    - later fracture of the femur (around or below the implant)
    - cut-out of the implant from the femoral head
    - non-union of the fracture
    - detachment of the implant from the femur
    - breakage of the implant
    - reoperation (within the follow-up period of the study)
    - wound infection: any (i.e. deep or superficial) or all deep wound infection (i.e. infection beneath the deep fascia)
    - wound haematoma

3. Post-operative complications
    - pressure sores
    - pneumonia
    - thromboembolic complications (deep vein thrombosis or pulmonary embolism)
    - any medical complication (as detailed in each individual study, excluding wound infections)
    - length of hospital stay (in days)

4. Anatomical restoration
    - leg shortening (preferably using the criterion of a > 2 cm reduction)
    - varus deformity
    - external rotation deformity (preferably using the criterion of a > 20 degrees deformity)

5. Final outcome measures
    - mortality (within the follow-up period of the study)
    - pain (persistent pain at the final follow-up assessment)

- mobility and use of walking aids
- failure to return to pre-fracture residential status
- functional activities of daily living
- composite function and hip scores

In our methodology quality assessment tool (*see* Methods) we have specified six months follow-up for all surviving trial participants as being acceptable. However, longer-term follow-up of at least one year or, better still, two years, is preferable to get a full view on mortality, function and reoperation resulting from complications and implant failure.

Search methods for identification of studies

Electronic searches

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (April 2010), the Cochrane Central Register of Controlled Trials (2010, Issue 1), MEDLINE (1950 to March week 5 2010) and EMBASE (1980 to 2010 Week 13). We searched the WHO International Clinical Trials Registry Platform Search Portal, Current Controlled Trials, and the UK National Research Register (NRR) Archive (all to April 2009) to identify ongoing and recently completed trials. No language or publication restrictions were applied.
The generic search strategies for hip fracture trials run in *The Cochrane Library* (Wiley Interscience) and MEDLINE (2002 onwards) are shown in Appendix 1. This MEDLINE search was combined with all three stages of the optimal trial search strategy (Higgins 2006). The general search strategy for hip fracture trials in EMBASE (2002 onwards) is shown in Appendix 1.

Searching other resources

We searched reference lists of articles and our own reference databases. We included the findings from handsearches of the British Volume of the Journal of Bone and Joint Surgery supplements (1996 to 2006),abstracts of the American Orthopaedic Trauma Association annual meetings (1996 to 2006) and American Academy of Orthopaedic Surgeons annual meetings (2004 to 2007). We also included handsearch results from the final programmes of SICOT (1996 and 1999) and SICOT/SIROT (2003), EFORT (2007) and the British Orthopaedic Association Congress (2000, 2001, 2002, 2003, 2005 and 2006). Up to 2007, we scrutinised weekly downloads of "Fracture" articles in new issues of Acta Orthopaedica Scandinavica (subsequently Acta Orthopaedica); American Journal of Orthopedics; Archives of Orthopaedic and Trauma Surgery; Clinical Orthopedics and Related Research; Injury; Journal of the American Academy of Orthopedic Surgeons; Journal of Arthroplasty; Journal of Bone and Joint Surgery (American and British Volumes); Journal of Orthopedic Trauma; Journal of Trauma; Orthopedics from AMEDEO. We contacted Howmedica Ltd UK (manufacturers of the Gamma nail) and Richards Ltd (manufacturers of the Intramedullary Hip Screw) and corresponded with colleagues.
Details of other searches conducted prior to 2000 are documented in Appendix 2.

Data collection and analysis

Selection of studies

Both review authors independently screened downloads from electronic databases and other sources for potentially eligible trials. We then independently selected trials for inclusion, usually based on full text reports. Trial authors were approached for further details of trial methods where necessary. Any disagreement was resolved by discussion.

Data extraction and management

Data for the outcomes listed above were independently extracted by both authors using a data extraction form. Any differences were resolved by discussion. Where necessary and practical, we contacted trialists for additional data and clarification.

Assessment of risk of bias in included studies

In the update of the review (2010), three aspects of risk of bias were assessed by one author (HH) and reported. These were sequence generation, allocation concealment and surgeons' experience with the devices. In this assessment, incomplete or a lack of information on sequence generation or allocation concealment was judged as 'unclear' risk of bias unless the trial was quasi-randomised, in which case both were rated 'no'. For risk of bias related to surgeons' experience with the devices prior to commencement of the trial, this was generally rated as 'high' where there was a lack of information on measures taken to avoid learning curve problems, often in the context of a large number of operating surgeons.
In addition, both authors independently assessed, without masking, each trial for 11 aspects of internal and external validity (*see* Table 2). Any disagreement was resolved by discussion. Care was taken to ensure consistency between item 1 (allocation concealment) and item 5 (surgeons' experience) of this assessment and the risk of bias judgements; both items were considered key items of assessment of trial validity in this and all previous versions of the review. Trial authors were contacted for further details of trial methodology where this was unclear.

Table 2. Methodological quality assessment scheme

Items	Scores
1. Was there clear concealment of allocation?	Score 3 if allocation was concealed (e.g. numbered sealed opaque envelopes drawn consecutively). Score 2 if there was a possible chance of disclosure before allocation. Score 1 if the method of allocation concealment or randomisation was not stated or was unclear. Score 0 if allocation concealment was clearly not concealed such as those trials using quasi-randomisation (e.g. even or odd date of birth).
2. Were the inclusion and exclusion criteria clearly defined?	Score 1 if text states the type of fracture and which patients were included and/or excluded. Otherwise score 0.
3. Were the outcomes of trial participants who withdrew or excluded after allocation described and included in an intention-to-treat analysis?	Score 1 if yes or text states that no withdrawals occurred, or data are presented that, by clearly showing 'participant flow', allow this to be inferred. Otherwise score 0.
4. Were the treatment and control groups adequately described at entry and if so were the groups well matched or appropriate covariate adjustment made?	Score 1 if at least four admission details given (e.g. age, sex, mobility, function score, mental test score, fracture type) with no significant difference between groups or appropriate adjustment made. Otherwise score 0.
5. Did the surgeons have prior experience of the operations they performed in the trial, prior to its commencement?	Score 1 if text states there was an introductory period or that surgeons were experienced. Otherwise score 0.
6. Were the care programmes other than trial options identical?	Score 1 if text states they were or if this can be inferred. Otherwise score 0.
7. Were the outcome measures clearly defined in the text with a definition of any ambiguous terms encountered?	Score 1 if yes. Otherwise score 0.
8. Were the outcome assessors blind to assignment status?	Score 1 if assessors of pain and function at follow-up were blinded to treatment outcome. Otherwise score 0.
9. Was the timing of outcome measures appropriate? A minimum of six-months follow-up for all surviving trial participants.	Score 1 if yes. Otherwise score 0.
10. Was loss to follow-up reported and if so were less than 5% of trial participants lost to follow-up?	Score 1 if yes. Otherwise score 0.
11. Were the authors able to provide supplementary details of the trial in addition to published data?	Score 1 if yes. Otherwise score 0.

Dealing with missing data

Where the number of participants providing data for any particular outcome was reported, we used these provided data. In studies for which a number of events were reported, but the denominator was unclear, we used numbers randomised or alive at follow-up. Sensitivity analyses using numbers randomised were done for any outcome for which denominators other than number randomised had been used, in order to assess any impact of missing data on results.

Assessment of heterogeneity

Heterogeneity between comparable trials was assessed by inspection of the overlap of confidence intervals amongst included studies and tested using a standard Chi^2 test, with additional consideration of the I^2 statistic (Higgins 2003); an I^2 of 50% or over representing substantial heterogeneity.

Data synthesis

For dichotomous outcomes, we reported risk ratios (RR) with 95% confidence intervals and for continuous outcomes, mean differences (MD) and 95% confidence intervals. Results of comparable groups of trials were pooled, using the Mantel-Haenszel method for dichotomous outcomes, and inverse variance for continuous data, and the fixed-effect model; unless heterogeneity was substantial (nominally, $P < 0.10$; $I^2 > 50\%$), when the random-effects model was used.

Subgroup analysis and investigation of heterogeneity

We recognised the possibility that developments of individual intramedullary or extramedullary implant designs, and implants produced by different manufacturers, while possessing many common features, might show some differences in effectiveness or adverse effects. We have therefore presented some analyses in which studies are grouped by implant design as well as others without subgroups. These enable readers to inspect the data, but where appropriate, we have explored the possibility that implant types do perform differently by performing test for subgroup differences. Some exploratory subgroup analyses, based on allocation concealment and the reportage of surgical experience, were performed to test potential bias. To test whether the subgroups were statistically significantly different from one another, we tested the interaction using the technique outlined by Altman 2003.

Sensitivity analysis

Some exploratory sensitivity analyses, based on allocation concealment and the reportage of surgical experience, were performed to test potential bias. Sensitivity analyses using numbers randomised were done for any outcome for which denominators other than number randomised had been used, in order to assess any impact of missing data on results.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting classification; Characteristics of ongoing studies.

In all 43 trials were included, 28 were excluded, three are awaiting assessment and five are ongoing. Details of the individual studies of these various groups are respectively in the Characteristics of included studies, Characteristics of excluded studies, Characteristics of studies awaiting classification; and Characteristics of ongoing studies.

Seven new trials were included in this update. Five involved participants with trochanteric fractures: Barton 2010 compared the long Gamma nail with the sliding hip screw (SHS); Little 2008 compared the long Holland nail with the SHS; Varela-Egocheaga 2009 compared the Gamma nail with the percutaneous compression plate (PCCP); Verettas 2010 compared two intramedullary nails (Gamma nail, Endovis BA nail) with the SHS; and Zou 2009 compared the proximal femoral nail antirotation with the SHS. The remaining two trials involved people with subtrochanteric fractures. Lee 2007 compared the Russel-Taylor Recon intramedullary nail with the dynamic condylar screw; and Rahme 2007 compared the proximal femoral nail (PFN) with the 95 degree blade plate. Two trials (Little 2008, formerly Fenando 2006; Rahme 2007, formerly Harris 2005) were in 'Studies awaiting classification' in the previous version of the review.

One newly identified study (Rafiq 2009) was added to studies awaiting assessment. Nine newly identified studies (Cao 2009; Hu 2006; Liu 2008; Nouisri 2006; Pan 2009; Saarenpaa 2009; Zhang 2009; Zhao 2009; Ziran 2009) were excluded. Four more ongoing studies were identified (Matre; Molnar; REGAIN; Schipper).

The trial populations for the various implant comparisons in the included trials are summarised below.

Gamma nail versus SHS

Twenty-two trials (Adams 2001; Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Hoffman 1996; Kukla 1997; Kuwabara 1998; Leung 1992; Marques Lopez 2002; Michos 2001; Mott 1993; O'Brien 1995; Ovesen 2006; Pahlpatz 1993; Papasimos 2005; Park 1998; Radford 1993; Utrilla 2005) compared the Gamma nail with the SHS in 3749, predominantly older, people. Benum 1994 was a multi-centre study for which data were only available for a subgroup of hospitals. The other multi-centre study (Ahrengart 1994) was based in Scandinavian countries. Since the results for participants with subtrochanteric fractures and 66 others who were lost to follow-up were not published in the full report of this trial (Ahrengart 2002), we continue to present the results from two centres reported in Fornander 1994. This means that the results for only 3080 trial participants, with 3082 fractures, are included in this review.

Eight trials (Ahrengart 1994; Benum 1994; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Michos 2001; Mott 1993) included subtrochanteric fractures as well as trochanteric fractures. Where recorded, the mean ages of trial participants ranged between 73 and 84 years and the proportion of male patients varied from 15% to 40% in individual studies.

Intramedullary hip screw (IMHS) versus SHS

The five trials (Baumgaertner 1998; Hardy 1998: Harrington 2002; Hoffmann 1999, Mehdi 2000) comparing the IMHS with the SHS involved a total of 623 people with 627 stable or unstable trochanteric fractures. The mean ages of the participants of individual trials were between 76 and 83 years and, where reported, proportion of males varied from 20% to 34%.

Full published reports were available for four trials (Baumgaertner 1998; Hardy 1998; Harrington 2002, Hoffmann 1999). A limited translation from German was obtained for Hoffmann 1999. A conference abstract (Hardy 1999) presenting the results of 160 people at 18 months follow-up is available for Hardy 1998 but, pending clarification of the limited results presented in the abstract, so far we have not included the results for the extra 60 participants. Mehdi 2000 has only been reported as a conference abstract, however unpublished material for this trial indicate that the limited results in the abstract applied to the whole trial population.

Proximal femoral nail (PFN) versus SHS

Three trials (Pajarinen 2005; Papasimos 2005; Saudan 2002), compared the proximal femoral nail (PFN) with the SHS in 394 people with trochanteric hip fractures. The mean ages of participants of the three trials ranged between 81 and 83 years, and the proportion of males varied between 22% to 39%.

Proximal femoral nail antirotation (PFNA) versus SHS

One trial (Zou 2009) compared the proximal femoral nail antirotation (PFNA) with the SHS in 121 people with trochanteric hip fractures. The mean age of the participants was 65 years, and 22% were male.

Targon PF (proximal femoral) nail versus SHS

One trial (Giraud 2005) compared a Targon PF intramedullary nail with the SHS in 60 people with stable or unstable trochanteric fractures. The mean age of trial participants was 82 years and 23% were male.

Long Holland nail versus SHS

One trial (Little 2008) compared a long Holland intramedullary nail with the SHS in 190 people with stable or unstable trochanteric fractures. The mean age of trial participants was 83 years and 15% were male.

Long Gamma nail versus SHS

One trial (Barton 2010) compared a long Gamma intramedullary nail with the SHS in 210 people with unstable trochanteric fractures. The mean age of trial participants was 83 years and 21% were male.

Mini-invasive static intramedullary nail versus SHS

One trial (Dujardin 2001) compared an experimental mini-invasive static intramedullary nail with the SHS in 60 people with stable or unstable trochanteric fractures. The mean age of trial participants was 83.5 years and 20% were male.

Kuntscher-Y nail versus SHS

One trial (Davis 1988) compared the Kuntscher-Y nail with the SHS. The 230 participants with trochanteric fractures had a mean age of 81 years and 17% were male.

Intramedullary nail (two types) versus the SHS

One study (Verettas 2010) compared two intramedullary nails (38 Gamma, 22 Endovis BA nails) versus the SHS. The 120 participants with trochanteric fractures had a mean age of 80 years and 30% were male. Follow-up was only for the duration of the hospital stay.

Intramedullary nails (various types) versus Medoff sliding plate

One trial (Miedel 2005) compared the Gamma nail with a Medoff sliding plate in 217 people with either an unstable trochanteric fracture (189 cases) or a subtrochanteric fracture (28 cases). The mean age of participants was 84 years and 19% were male. Another trial (Ekstrom 2007) compared the proximal femoral nail (PFN) with a Medoff sliding plate in 203 people (out of 210 recruited) with either an unstable trochanteric fracture (172 cases) or a subtrochanteric fracture (31 cases). The mean age of participants was 82 years and 24% were male.

Gamma nail versus the percutaneous compression plate (PCCP)

One trial (Varela-Egocheaga 2009) compared the Gamma nail with a PCCP in 80 people with a trochanteric fracture. The mean age of participants was 82 years and 21% were male.

Intramedullary nails (various types) versus fixed (static) extramedullary plates for lower trochanteric fractures

One trial (Pelet 2001) compared the Gamma nail with a blade plate in 26 people (mean age 71 years; 35% male) with a comminuted trochanteric fracture, classified as Kyle type IV. These fracture patterns approximate to those of type 31A3 fractures in the AO classification of fractures with reversed fracture pattern or transverse fracture lines at the level of the lesser trochanter (Muller 1991). Sadowski 2002 compared the PFN with the dynamic condylar screw in 39 people (mean age 79 years; 31% male) with type 31A3 fractures.

Intramedullary nails (various types) versus fixed (static) extramedullary plates for subtrochanteric fractures

One trial (Lee 2007) compared the Russell-Taylor Recon nail with a dynamic condylar screw in 66 people (mean age 36 years; 77% male) with a subtrochanteric fracture; data for an additional 11 participants were excluded from the trial results. Rahme 2007 compared the PFN with a blade plate in 60 people (mean age 70 years; 43% male) with a subtrochanteric fracture.

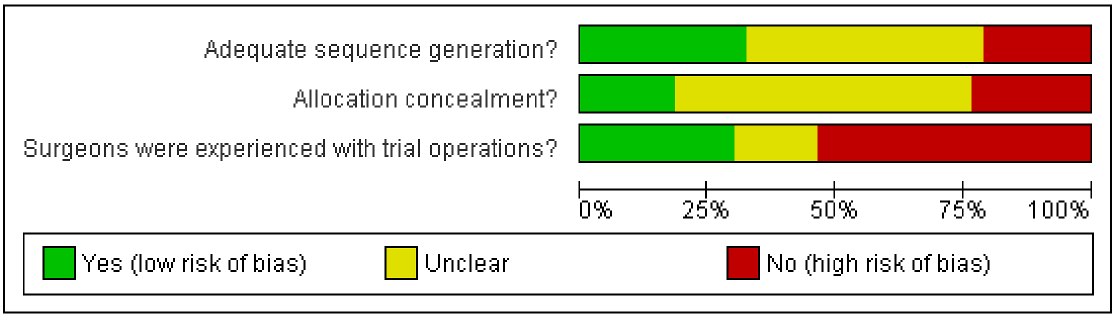
Risk of bias in included studies

Figure 1 shows the risk of bias judgements for individual trials for sequence generation (selection bias), allocation concealment (selection bias) and surgeons' experience (performance bias). These are also described in the Characteristics of included studies, both in the 'Methods' and 'Risk of bias' sections. Figure 2 is a visual presentation of the proportions 'low', 'unclear' and 'high' risk of bias judgements across all the included studies for the three assessed items. These judgements were dependent to a great extent on the quality of reporting of trials and whether clarification had been received from authors on the method of randomisation and surgeons' experience. Low risk of bias judgements on sequence generation were assigned to 14 trials (33%) and on allocation concealment for eight trials (19%). Only five trials provided sufficient evidence of adequate sequence generation and allocation concealment (Baumgaertner 1998; Davis 1988; Hoffman 1996; Ovesen 2006; Pajarinen 2005). All nine quasi-randomised trials (Butt 1995; Goldhagen 1994; Guyer 1991; Hardy 1998; Lee 2007; Leung 1992; Marques Lopez 2002; Park 1998; Verettas 2010) were judged at high risk of bias for both items. In 13 trials, information indicating that surgeons had prior experience with the implants under investigation was sufficient to judge that there was a low risk of related performance bias. However, over half the trials (23/43) were judged at high risk of bias for this item. This included five trials (Baumgaertner 1998; Harrington 2002; Leung 1992; Marques Lopez 2002; Pelet 2001) where there was a confirmed disparity in the experience of surgeons with respect to the devices being compared. More details of this and randomisation methods are presented below.

Figure 1. Risk of bias summary: judgements about each risk of bias item for each included study.

	Adequate sequence generation?	Allocation concealment?	Surgeons were experienced with trial operations?
Adams 2001	?	+	+
Ahrengart 1994	?	?	+
Barton 2010	+	?	+
Baumgaertner 1998	+	+	−
Benum 1994	?	?	−
Bridle 1991	?	?	+
Butt 1995	−	−	−
Davis 1988	+	+	−
Dujardin 2001	?	?	+
Ekstrom 2007	+	?	−
Giraud 2005	+	?	−
Goldhagen 1994	−	−	−
Guyer 1991	−	−	−
Hardy 1998	−	−	−
Harrington 2002	?	?	−
Haynes 1996	?	−	−
Hoffman 1996	+	+	−
Hoffmann 1999	?	+	−
Kukla 1997	?	?	+
Kuwabara 1998	?	?	?
Lee 2007	−	−	+
Leung 1992	−	−	−
Little 2008	+	?	?
Marques Lopez 2002	−	−	−
Mehdi 2000	?	?	?
Michos 2001	?	?	?
Miedel 2005	?	?	−
Mott 1993	+	?	−
O'Brien 1995	?	+	−
Ovesen 2006	+	+	−
Pahlpatz 1993	?	?	−
Pajarinen 2005	+	+	+
Papasimos 2005	?	?	−
Park 1998	−	−	?
Pelet 2001	+	?	−
Radford 1993	?	?	+
Rahme 2007	?	?	−
Sadowski 2002	+	?	+
Saudan 2002	+	?	+
Utrilla 2005	?	?	+
Varela-Egocheaga 2009	+	?	+
Verettas 2010	−	−	?
Zou 2009	?	?	?

Figure 2. Risk of bias graph: judgements about each risk of bias item presented as percentages across all included studies.



The results of the methodological assessment for individual trials are given in Appendix 3. These are ordered by comparison; note that Papasimos 2005 appears in two categories. Further details of allocation concealment and randomisation (Item 1), surgeon's experience (Item 5) and assessor blinding (Item 8) are also presented. Sixteen trials randomised using envelopes; these were described as sealed in 14 trials (Adams 2001; Ahrengart 1994; Baumgaertner 1998; Davis 1988; Ekstrom 2007; Harrington 2002; Hoffman 1996; Hoffmann 1999; Kukla 1997; Mehdi 2000; Miedel 2005; Ovesen 2006; Pajarinen 2005; Utrilla 2005), mixed in Benum 1994 and blinded in O'Brien 1995. Seven trials (Baumgaertner 1998; Davis 1988; Hoffman 1996; Hoffmann 1999; O'Brien 1995; Ovesen 2006; Pajarinen 2005) indicated that the randomisation was blinded. Blinded randomisation was also claimed for Pelet 2001, which used the drawing of lots, but safeguards were not described. Computer generated randomised numbers were used for Mott 1993, Sadowski 2002 and Saudan 2002. Computer-mediated randomisation was reported for Little 2008. Giraud 2005 and Varela-Egocheaga 2009 used a random numbers table. A further nine trials were quasi-randomised in which the treatment allocation was inadequately concealed using either alternating patient admission (Guyer 1991; Leung 1992; Verettas 2010), medical record numbers (Goldhagen 1994; Hardy 1998; Lee 2007; Marques Lopez 2002; Park 1998), or an even or odd week of admission (Butt 1995). Though Haynes 1996 used randomisation cards, allocation concealment was deemed unlikely as the imbalance in the treatment group numbers was attributed to surgeons withdrawing a patient from the trial when they considered themselves unfamiliar with the Gamma nail. The remaining trials did not specify their method of randomisation.

Brief details of surgical experience (item 5) as reported for individual trials are given in the Characteristics of included studies.

For several trials, surgeons may have been more experienced with the SHS than the newer implant (the intramedullary nail). This disparity of experience was certainly true for Baumgaertner 1998 and Harrington 2002 where the participating surgeons had experience with using sliding hip screws but not specifically with the IMHS despite being familiar with the techniques involved. Also in Leung 1992, where most of the Gamma nail operations were performed by one senior surgeon with a special interest in intramedullary nailing whilst the SHS operations were performed by a variety of often less experienced surgeons. And in Marques Lopez 2002, where the majority of Gamma nail operations were performed by specialists and conversely the majority of SHS operations were done by junior or senior residents. In addition, surgeons were more experienced with the Gamma nail than with the blade plate in Pelet 2001.

Only four trials (Adams 2001; Harrington 2002; Hardy 1998; Hoffman 1996) included blinded assessment of some outcomes (item 8).

We note the possibility of selective reporting from either those trials apparently completed but for which complete trial data have neither been published nor made available (Ahrengart 1994; Benum 1994; Hogh 1992), or trials which may not have been completed (Pahlpatz 1993; Prinz 1996).

Effects of interventions

These are presented by the type of cephalocondylic nail being compared with the extramedullary plate device (sliding hip screw, the Medoff plate, or the percutaneous compression plate) and, for four studies, a fixed nail plate (dynamic condylar screw or blade plate). The outcome measures listed earlier were sought for all studies and, where available, results are presented in the analyses. Reported outcomes are also listed in the Characteristics of included studies. The key pooled outcomes for all except two (see below) of the femoral nails versus the sliding hip screw are given first, followed by the results for each type of nail. The experimental nature, including the lack of commercial availability, of the mini-invasive intramedullary nail should be noted when viewing the results of this trial and was the reason for not including it at present in the pooled femoral nail analysis. The results for the Kuntscher-Y nail were also not pooled with the other nails because this earlier version of a cephalocondylic nail does not have the capacity for distal locking.

The included trials generally used similar outcome measures with regard to surgical fixation failure and operative details. Wound infection was usually more difficult to quantify and it was not possible to differentiate between superficial and deep wound infection for many of the trials. Mortality was taken as that which occurred within the follow-up period for each study. The outcome measures of residual pain, change in mobility and function are more difficult to quantify and were recorded in far fewer trials. Moreover, because no standardised assessment was used for all trials, only a limited evaluation was possible for these outcomes. Data from each trial which could be pooled are presented graphically. As reported in Methods, we performed sensitivity analyses to explore the effects of our choice for denominators when these were not clearly stated in trial reports. No significant changes in the pooled results were encountered.

Femoral nails (Gamma, IMHS, PFN, Targon PF, Holland nail, PFNA, Long Gamma nail) versus the sliding hip screw (SHS)

To avoid double counting of the participants of the SHS group, where available the combined data for the Gamma nail and PFN groups of Papasimos 2005 are presented in a separate sub-category (8 in Analyses 1.2 to 1.6). Thus the results for Papasimos 2005 do not appear in the Gamma nail (sub-category 1) or PFN (sub-category 3) analyses. The pooled results for these nails demonstrate a significantly lower incidence for operative fracture of the femur (*see* Analysis 1.2: 37/1963 versus 7/1968; RR 3.16, 95% CI 1.73 to 5.79) and later fracture of the femur (*see* Analysis 1.3: 39/1933 versus 2/1916; RR 5.22, 95% CI 2.56 to 10.64) in favour of the SHS. Although dominated by the results from the Gamma nail, there was remarkable homogeneity in the results of the trials within and between the separate categories for these outcomes. These complications contribute to the significantly greater reoperation rate for femoral nails (*see* Analysis 1.6: 108/1948 versus 70/1961; RR 1.49, 95% CI 1.12 to 1.98).

Pooled results for cut-out (*see* Analysis 1.4), non union (*see* Analysis 1.5), deep wound infection (*see* Analysis 1.7) and mortality (*see* Analysis 1.8) show no difference between the two types of implant, and again show uniformity. Far fewer data were available for the three other outcomes (length of surgery, pain and non return to previous residence or dead) presented graphically (*see* Analysis 1.1, Analysis 1.9 and Analysis 1.10 respectively); none showed a statistically significant difference between the two groups. The heterogeneity in the length of surgery results continues to be striking.

Individual comparisons

Gamma nail versus the sliding hip screw (SHS)

Data for 3080 people were available from the 22 randomised controlled trials (Adams 2001; Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Hoffman 1996; Kukla 1997; Kuwabara 1998; Leung 1992; Marques Lopez 2002; Michos 2001; Mott 1993; O'Brien 1995; Ovesen 2006; Pahlpatz 1993; Papasimos 2005; Park 1998; Radford 1993; Utrilla 2005) comparing the Gamma nail with the SHS. Eight trials (Ahrengart 1994; Benum 1994; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Michos 2001; Mott 1993) included subtrochanteric fractures as well as trochanteric fractures. It is important to note that data are unavailable and may be lost for over 1000 trial participants from either those trials apparently completed but for which complete trial data have neither been published nor made available (Ahrengart 1994; Benum 1994; Hogh 1992) or trials which may not have been completed (Pahlpatz 1993; Prinz 1996). Different versions of the Gamma nail were used: the early studies used the 'Gamma 1' nail and the later studies used the Gama 3 or trochanteric Gamma nail (Ovesen 2006; Papasimos 2005; Utrilla 2005). The results of all these trials have been pooled in this review. Inspection of the analyses for various fracture fixation complications and reoperation shows no indication of a marked difference in results in the two groups of trials; overall, there was no statistical heterogeneity in any of the pooled results (I^2 = 0% in all analyses). We subgrouped these trials by Gamma nail design (Gamma 1 and Trochanteric Gamma nail) for operative fracture and reoperation.

Operative details

Most trials reporting length of surgery indicated that there was no difference or no significant difference between the two implants for this outcome (Bridle 1991; Butt 1995; Goldhagen 1994; Hoffman 1996; Leung 1992; Kukla 1997; Kuwabara 1998; Marques Lopez 2002; Mott 1993; Radford 1993). Five trials, however, found increased operating times for the Gamma nail (Ahrengart 1994; Benum 1994; Haynes 1996; O'Brien 1995; Ovesen 2006). Conversely, Adams 2001 and Park 1998 reported a significant reduction in operating times for the Gamma nail. This probably applied also to Papasimos 2005. Data for Leung 1992 which also showed a significant reduction in operating times for the Gamma nail were removed from the analysis as they were inconsistent with the statements in the text. Pooled results of the six trials (*see* Analysis 2.1) providing data for length of surgery showed no evidence of difference between the two implants but also considerable heterogeneity ($chi^2 = 34.80$, $P < 0.00001$; $I^2 = 86\%$).

There were no significant differences for blood loss or for transfusion requirements reported in 12 studies (Adams 2001; Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Guyer 1991; Kukla 1997; Kuwabara 1998; Mott 1993; O'Brien 1995; Papasimos 2005). Others (Haynes 1996; Leung 1992; Park 1998; Radford 1993) found a significantly lower blood loss for the Gamma nail, as did Fornander (Fornander 1994) in the two-centre analysis for Ahrengart 1994. Michos 2001 also reported a lower blood loss for the Gamma nail group but did not indicate if this was a statistically significant result. One study (Hoffman 1996) found an increased blood loss for the Gamma nail. Whilst data from five studies (Adams 2001; Kukla 1997; Leung 1992; O'Brien 1995; Ovesen 2006) are shown in Analysis 2.2, the lack of available data from other trials means that no firm conclusion can be drawn. The significant heterogeneity of the pooled results ($chi^2 = 8.31$, $P = 0.08$; $I^2 = 52\%$) can be attributed to the inclusion of the more extreme results of Leung 1992; removal of these reveals the more homogenous results of the other four trials (mean difference -11.64 ml, 95% CI -40.14 to 16.85, $chi^2 = 0.71$, $P = 0.87$; analysis not shown). The three trials (Adams 2001; Ovesen 2006; Utrilla 2005) reporting the numbers of people receiving blood transfusion had significantly heterogeneous results ($chi^2 = 9.77$, $P = 0.008$); when pooled these showed no significant difference between the two groups (*see* Analysis 2.3).

Seven studies reported radiographic screening time. Goldhagen 1994, Marques Lopez 2002 and Papasimos 2005 reported that the increased time for the Gamma nail did not reach statistical significance. Data for the other four trials, all of which had statistically significant findings, are presented in Analysis 2.4. Pooling of the limited data was not done in view of the very major heterogeneity ($chi^2 = 130.84$, $P < 0.00001$), with Leung 1992 and Utrilla 2005 reporting a significantly lower screening time for the Gamma nail and the other two studies (Hoffman 1996; O'Brien 1995), a significantly higher time. While we conjecture that the results for Leung 1992 may reflect the disparate experience of the surgeons performing the two operations in this trial, this probably does not apply to Utrilla 2005.

Fracture fixation complications

Pooled data from 18 trials shows the incidence of operative fracture of the femoral diaphysis is significantly increased when the Gamma nail is used (*see* Analysis 2.5: 27/1351 versus 6/1379; RR 3.02, 95% CI 1.51 to 6.03). (Visually, no obvious trend in the incidence of this outcome is observed when the trials are arranged by date of publication.) Test for interaction showed no statistically significant difference (two tail z-test = 0.656) between the two Gamma nail designs. When the trials were subgrouped (*see* Analysis 2.6) according to the trial report of surgeon's experience with the devices used, the test of interaction showed no statistically significant difference (two tail z-test = 0.374) in results of the trials where the surgeons were reported to be experienced with the devices and those trials where either no information was provided or a lack of prior experience was reported.

Subsequent fracture of the femur around the implant occurred in 35 cases of Gamma nailing but in only two cases of SHS fixation (*see* Analysis 2.7: 35/1332 versus 2/1341; RR 5.23, 95% CI 2.46 to 11.14).

Pooled data for cut-out of the implant from the femoral head showed no difference between implants (*see* Analysis 2.8: 46/1334 versus 41/1361; RR 1.15, 95% CI 0.76 to 1.72). Analysis 2.9 shows the trials subgrouped by reported experience of surgeons with the devices: there was no statistically significant difference between the two subgroups (test for interaction: two tail z-test = 0.539). Where reported, there was also no difference in the incidence of non-union (or non healed fractures) (*see* Analysis 2.10), or time to union or for fracture healing (no analyses shown).

Fracture of the femur was the main reason for a significantly increased reoperation rate for the Gamma nail (*see* Analysis 2.11, pooled results from 18 studies: 86/1320 versus 52/1345; RR 1.66, 95% CI 1.19 to 2.31). Test for interaction showed no statistically significant difference (two tail z-test = 0.347) between the two Gamma nail designs.

Wound infection (presented as either any infection or deep wound infection) and, when reported, wound haematoma showed no significant difference between the two implants as shown in Analysis 2.12.

Post-operative complications

The available data showed no statistically significant differences between implants for the complications of pneumonia (nine studies: *see* Analysis 2.13), pressure sores (five studies: *see* Analysis 2.14), thromboembolic complications (12 studies: *see* Analysis 2.15), and any medical complications other than wound infection or haematoma (six studies: *see* Analysis 2.16).

With the exception of Michos 2001, all studies reporting hospital stay stated there were no differences or no significant differences in this outcome between the two implants (Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Haynes 1996; Hoffman 1996; Kukla 1997; Leung 1992; Marques Lopez 2002; O'Brien 1995; Ovesen 2006; Papasimos 2005; Radford 1993). This is supported by the limited data available for pooling (five trials: *see* Analysis 2.17).

Anatomical restoration

Three measures of anatomical deformity are presented in Analysis 2.18.

Pooled data on limb shortening from three trials, two (Kukla 1997; Leung 1992) which reported numbers of people with over two centimetres of shortening and one (Guyer 1991) which reported numbers of people with over one centimetre of shortening, showed no statistically significant differences between implants (RR 0.46, 95% CI 0.21 to 1.03). All the three other trials (Ahrengart 1994; Hoffman 1996; Utrilla 2005) reporting this outcome found no significant differences between the two groups.

The results, which tended to favour the Gamma nail group are dominated by the results of the latter trial in the pooled results of data from just three of the five trials. Utrilla 2005 reported no statistically significant difference between the two groups (mean shortening: 4.5 mm versus 3.2 mm; P = 0.35).

Data for varus deformity (expressed as angulation greater than 10 degrees, malunion or deformity) provided by five studies reporting this outcome, showed no statistically significant difference between the two groups.

External rotation deformity was reported by two studies (Kuwabara 1998; Leung 1992), which found no difference between the two groups.

Final outcome measures

Mortality data measured from between three and 12 months, available for pooling from 16 studies, show no significant difference in mortality between the two implants (*see* Analysis 2.19: 209/1136 versus 228/1170; RR 0.95, 95% CI 0.81 to 1.12). The potential effect of selection bias (testing a post-hoc hypothesis that there would be a tendency to place more frail and ill patients in the SHS group) was investigated by subgrouping the data according to allocation concealment (*see* Analysis 2.20). Although Analysis 2.20 is consistent with a higher risk of mortality in the SHS group when allocation is not concealed, the test of interaction between trials with allocation concealment and those with no concealment of allocation was not statistically significant (two tail z-test = 0.533); thus there is insufficient evidence to draw conclusions.

Of the seven studies reporting post-operative pain (Ahrengart 1994; Goldhagen 1994; Guyer 1991; Hoffman 1996; Leung 1992; O'Brien 1995; Utrilla 2005), only Ahrengart 1994 reported a significant difference between the two implants. Pooling of pain outcome data is hampered by the different methods of assessing residual pain performed at different time intervals from injury. When pooled, data from five trial showed no significant difference between the two implants in patients with residual pain (*see* Analysis 2.21).

The return to pre-fracture residential status, expressed in various ways such as transfer to long-term care and stay in institutions, as well as return to pre-fracture residence, was stated or implied as being no different in nine trials (Ahrengart 1994 (two centre data); Adams 2001; Benum 1994; Bridle 1991; Goldhagen 1994; Hoffman 1996; O'Brien 1995; Pahlpatz 1993; Radford 1993). Four trials (Ahrengart 1994; Guyer 1991; Haynes 1996; Pahlpatz 1993) provided data for pooling. Neither the analysis for non-return to previous residence for survivors nor that for overall non-return including deaths showed a significant difference between the two implants (*see* Analysis 2.22).

Measures of mobility varied between studies and were broadly based on the numbers able to walk independently, the numbers requiring walking aids and those who were bed or chair bound. Some studies (Hoffman 1996; Marques Lopez 2002) further refined this by ranking or scoring systems and recorded the difference in levels of attainment between pre-fracture and post-fracture mobility. Utrilla 2005 also presented a walking ability score. Where reported, pre-fracture mobility was said to be comparable between implant groups with the exception of Hoffman 1996 where the pre-fracture status was better in the Ambi (SHS) group. Eleven studies (Ahrengart 1994; Benum 1994; Bridle 1991; Goldhagen 1994; Kukla 1997; Kuwabara 1998; Marques Lopez 2002; O'Brien 1995; Ovesen 2006; Radford 1993; Utrilla 2005) found no difference in post-operative mobility or changes in mobility. Hoffman 1996, the only study to use blinded assessment of mobility, reported better mobility with the SHS in the early stages, but no difference at 12 weeks. Although loss of mobility data were presented by a histogram in Bridle 1991, these differed from results given in text. Analysis 2.23 shows pooled results from seven trials for the numbers of trial participants with impaired walking (RR 0.99, 95% CI 0.89 to 1.10). This provides an incomplete picture of mobility, but reinforces the claims from the other trials of there being no difference in mobility outcomes between the two implants.

Adams 2001 found no difference between the groups in the Harris hip scores for the survivors at one year. Papasimos 2005 reported a higher Salvati and Wilson score (based on pain, walking, muscle power and motion, function; 0: worst to 40: best) at one year for the nail group (mean: 33 versus 27; P value not reported).

Economic evaluation

None of the included trials reported costs or attempted an economic evaluation.

Intramedullary hip screw (IMHS) versus the sliding hip screw (SHS)

Five randomised trials (Baumgaertner 1998; Hardy 1998; Harrington 2002; Hoffmann 1999; Mehdi 2000) compared the IMHS with the SHS in 623 people with trochanteric fractures. Only very limited results were available for Mehdi 2000.

Operative details

Mean operating times in the IMHS group relative to those for SHS group were less in two trials (Baumgaertner 1998; Hoffmann 1999), but greater in the other three. Pooled results from three trials (Baumgaertner 1998; Hardy 1998; Harrington 2002) show highly significant heterogeneity (P = 0.001; I^2 = 85%), and a statistically non significant result when the random-effects model is applied (*see* Analysis 3.1).

Mean operative blood loss was significantly lower in the IMHS group (*see* Analysis 3.2: mean difference -62.42 ml, 95% CI -98.56 to -26.28 ml; Hoffmann 1999 and Mehdi 2000 also reported lower mean values for the IMHS group (380 ml versus 400 ml; 247 ml versus 270 ml). There were no significant differences between the two groups in units of blood transfused (*see* Analysis 3.3) or numbers of patients receiving transfusion.

Radiographic screening times were longer for the IMHS group were longer (*see* Analysis 3.5: mean difference 1.15 minutes, 95% CI 0.83 to 1.47 minutes; Hoffmann 1999: 5.7 versus 5.4 minutes, reported as not significant).

Fracture fixation complications

Pooled data as available for operative fracture of the femur, later fracture of the femur, cut-out, non-union, plate detachment and reoperation are shown in Analysis 3.6. Only the result for operative fracture, which occurred only in the IMHS group, was statistically significant (8/313 versus 0/314; RR 5.01, 95% CI 1.11 to 22.65). Complete data on reoperations (done mainly, where described, to remove painful hardware and for loss of fracture fixation) were available from two trials only.

There were no significant differences between groups in wound infection (the only reported case occurred in the SHS group of Mehdi 2000; *see* Analysis 3.7) or wound haematomas (*see* Analysis 3.7).

Post-operative complications

There were no significant differences between groups in post-operative medical complications (*see* Analysis 3.8), or length of hospital stay (*see* Analysis 3.9; Hoffmann 1999: median stay in orthopaedic ward: 10 versus 11 days).

Anatomical restoration

Hardy 1998 reported that, for those patients who underwent radiographic evaluation at fracture consolidation, there was a significantly reduced mean shortening of the fractured leg in the IMHS group (*see* Analysis 3.10: mean difference -0.70 cm, 95% CI -1.13 to -0.27 cm). Hoffmann 1999 reported that shortening of more than one centimetre occurred in one person of each group; and that one IMHS group participant had a "relevant" rotational deformity of the limb.

Final outcome measures

The available data for these outcomes are presented in Analysis 3.11. There were no significant differences between the two groups in mortality (54/221 versus 60/222; RR 0.91, 95% CI 0.67 to 1.24), pain at final follow-up, failure to return home (survivors), failure to return home or dead, or mobility outcomes.

Hardy 1998 reported significantly better mobility scores for the IMHS group at one and three months but not at six or 12 months; however, walking ability outside the home remained better in the IMHS group. Hoffmann 1999 reported no significant difference between groups in the Merle d'Aubigne score; an unsatisfactory score was attained by two IMHS patients and three SHS patients. Mehdi 2000 considered that their study showed that functional outcome of the IMHS was equivalent to the SHS but provided no supporting data.

Economic evaluation

Baumgaertner 1998 provided data for hospital charges which showed that on average those for the IMHS group were $6000 (USA) more. This difference was reported not to be statistically significant. It was unclear how the hospital charges were derived.

Proximal femoral nail (PFN) versus sliding hip screw (SHS)

This comparison was evaluated by three trials (Pajarinen 2005; Papasimos 2005; Saudan 2002) in 394 people with trochanteric hip fractures.

Operative details

Both Pajarinen 2005 and Papasimos 2005 reported a statistically significantly higher median length of surgery for the PFN group (respectively: 55 versus 45 minutes, reported $P = 0.011$; 71 versus 59 minutes, reported $P < 0.05$), whilst Saudan 2002 found no difference between the two groups (*see* Analysis 4.1). There were no significant differences reported between groups in mean blood losses (*see* Analysis 4.2; for Papasimos 2005, operative blood loss: 265.0 ml versus 282.4 ml; reported $P > 0.05$) or for mean number of units of blood transfused (*see* Analysis 4.2). However, fewer people received transfusion in the PFN group of Saudan 2002 (*see* Analysis 4.3: 55/100 versus 72/106; RR 0.81, 95% CI 0.65 to 1.01). Saudan 2002 found the mean radiographic screening time was about one minute longer in the PFN group (*see* Analysis 4.4), while Papasimos 2005 found no significant difference (0.26 versus 0.21 minutes; reported $P > 0.05$).

Fracture fixation complications

There were no intra-operative or later fractures of the femur. Similar numbers of cut-out occurred in the two groups (*see* Analysis 4.5) and there was one case of non-union in the SHS group of Papasimos 2005. There was a statistically non-significant tendency for a higher reoperation rate (13/194 versus 7/200; RR 1.90, 95% CI 0.78 to 4.62) for the PFN. No details of the reoperations were

given in Pajarinen 2005. In the other two trials, reoperations entailed implant removal (four versus one), implant removal and debridement (three versus one), a hip prothesis (four versus two) and an alternative fixation method (zero versus one).
There were no significant differences in the reported incidences of wound infections and haematomas (*see* Analysis 4.6).

Post-operative complications

As shown in Analysis 4.7, there were no significant differences between the two groups in the incidence of individual post-operative complications, except for urinary tract infection in Sadowski 2002. However, there was no statistically significant difference in the overall numbers of people with any medical complication (52/100 versus 49/106; RR 1.12, 95% CI 0.85 to 1.49) in this trial. There were no statistically significant differences between the two devices in the mean lengths of hospital stay for all three trials (*see* Analysis 4.8; for Papasimos 2005: 8.8 versus 9.9 days).

Anatomical restoration

Clinical measures such as limb shortening were not reported by any of the trials. Papasimos 2005 reported two cases of malrotation and two cases of varus or valgus deformity in each of the nail and SHS groups.

Final outcome measures

These outcomes presented in Analysis 4.9. There were no statistically significant differences in mortality, in residential status at final follow up, either in terms of the numbers of people in institutional care (Saudan 2002) or failing to return to the same residential status (Pajarinen 2005). Combined outcomes representing unfavourable outcomes (e.g. in nursing home or dead) also showed no significant differences between the two groups (*see* Analysis 4.9). Papasimos 2005 reported there was no difference between the two groups in return to pre-fracture level of independence or ambulation. Though, Pajarinen 2005 found that significantly fewer PFN group participants failed to recover their pre-fracture mobility (10/42 versus 19/41, RR 0.51, 95% CI 0.27 to 0.97), this result is not robust as shown by the combined outcome of failure to recover previous mobility or dead at four months (RR 0.67, 95% 0.38 to 1.17). For survivors available at one year, Saudan 2002 found no statistically significant differences between groups in pain, mobility or social function (mean scores: 2.88 versus 2.65). Papasimos 2005 reported comparable mean Salvati and Wilson scores (based on pain, walking, muscle power and motion, function; 0: worst to 40: best) at one year: 30 versus 27.

Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

This comparison was evaluated by one trial (Zou 2009) in 121 people with trochanteric hip fractures. Use of the PFNA was associated with significantly reduced operative time and operative blood loss (*see* Analysis 5.1 and Analysis 5.2), but a significantly increased radiographic screening time (*see* Analysis 5.3). There were no statistically significant differences between PFNA and SHS for implant cut-out, later fracture of the femur, non-union, implant breakage, or reoperation (*see* Analysis 5.4), wound infection (*see* Analysis 5.5), post-operative complications (*see* Analysis 5.6), mean hospital stay (14 days in both groups), or function (poor or fair Salvati and Wilson score) at one year (*see* Analysis 5.7).

Targon PF nail versus the sliding hip screw (SHS)

One study (Giraud 2005) compared the Targon PF nail with the sliding hip screw in 60 people with intertrochanteric fractures.
There was no statistically significant differences found between implants for mean length of surgery (34 versus 42 minutes), mean operative blood loss (410 versus 325 ml), cut-out (all five cases were reoperated) or reoperation (*see* Analysis 6.1), wound infection (*see* Analysis 6.2), post-operative complications (*see* Analysis 6.3), or mean length of hospital stay (11 days in both groups). Similar findings apply to mortality at three months (*see* Analysis 6.4), mean times to walking (20 versus 25 days), and mean Harris hip scores (60 versus 59; 0: worst to 100: best function).

Long Holland nail versus the sliding hip screw (SHS)

One study (Little 2008) compared the long Holland nail with the sliding hip screw in 190 people with intertrochanteric fractures.
Use of the long Holland Nail was associated with significantly longer mean lengths of anaesthesia and surgery (*see* Analysis 7.1), and radiographic screening (*see* Analysis 7.2), but with significantly less blood loss (*see* Analysis 7.3) and significantly fewer patients given transfusion (*see* Analysis 7.4: 7/92 versus 23/98; RR 0.32, 95% CI 0.15 to 0.72). Mean time to mobilisation was significantly lower in the nail group (*see* Analysis 7.5: 3.6 versus 4.3 days; mean difference -0.70 days, 95% CI -1.24 to -0.16).
There were no statistically significant differences between groups for fracture fixation complications or reoperation (one case of cut-out in the SHS group was revised to an Holland nail) (*see* Analysis 7.6), wound infection (*see* Analysis 7.7), post-operative complications (*see* Analysis 7.8), or mortality at one year (*see* Analysis 7.9).
More patients in the SHS group failed to regain their mobility (*see* Analysis 7.9: 27/76 versus 50/80; RR 0.57, 95% CI 0.40 to 0.80). Also, survivors treated with the Holland nail had better mobility scores at one year (*see* Analysis 7.10: 5.9 versus 3.8; RR 2.10, 95% CI 1.32 to 2.88).

Long Gamma nail versus the sliding hip screw (SHS)

One study (Barton 2010) compared the long Gamma nail with the sliding hip screw in 210 people with unstable intertrochanteric fractures. In the trial report, adjustments were made to correct for the significantly lower mini-mental scores in the nail group at baseline.

There were no statistically significant differences between groups for the numbers of participants transfused (*see* Analysis 8.1), fracture fixation complications (all five patients with lag screw cut-out had a reoperation: *see* Analysis 8.2), wound infection (*see* Analysis 8.3), adjusted length of hospital stay, mortality at one year (*see* Analysis 8.4), change scores for measures of mobility and residence, and adjusted quality of life scores.

Mini-invasive intramedullary nail versus the sliding hip screw (SHS)

One study (Dujardin 2001) compared this experimental implant with the sliding hip screw in 60 people with trochanteric fractures. Mean length of surgery, operative and total blood loss (including the blood loss into wound drains) were all significantly less in the nail group (*see* Analysis 9.1 and Analysis 9.2). No participants of the nail group required transfusion, whilst on average 1.5 units of blood per participant were transfused in the SHS group (reported P < 0.001). Radiographic screening time was equal in both groups (Analysis 9.3).

Dujardin 2001 reported an absence of early post-operative complications (specifically, thromboembolism, sepsis and further surgery). All fractures eventually united with no difference between the two implants in the time taken for fracture healing (*see* Analysis 9.4).There was no difference between groups in mortality at six months (*see* Analysis 9.5). Time to painless mobilisation and time to effective weight bearing (*see* Analysis 9.6) were both statistically significantly reduced for participants in the nail group, who also returned home earlier (46 versus 68 days; reported P < 0.05) than those in the SHS group.

The mean pain score was better for the nail group at six weeks (reported P < 0.01) but similar thereafter. No significant difference was noted for functional deficit at follow-up. However, the hip power and motion score was reported to be significantly better in the nail group at six months (reported P < 0.05).

Kuntscher-Y nail versus the sliding hip screw (SHS)

One randomised trial (Davis 1988) compared the Kuntscher-Y nail with the sliding hip screw (SHS) in 230 people with intertrochanteric fractures.

No significant differences were found between implants for fracture fixation complications or reoperation (*see* Analysis 10.1*),* wound infection (*see* Analysis 10.2*)* or post-operative complications (*see* Analysis 10.3*).*

Davis 1988 found a significant increase in the number of trial participants with more than 2.5 cm of shortening after Kuntscher nailing (17/48 versus 9/54; RR 2.13, 95% CI 1.05 to 4.31; *see* Analysis 10.4). There were no significant differences between implants for other measures of anatomical deformity, nor for mortality or mobility at one year (*see* Analysis 10.5*).*

Intramedullary nail (two types) versus the sliding hip screw (SHS)

Verettas 2010 compared 60 patients treated with an intramedullary nail (38 Gamma nails, 22 Endovis BA nail) with 60 patients treated with the SHS.

No significant differences were found between the use of nails or SHS for duration of surgery (means: 42 versus 45 minutes), operative blood loss (means: 150 versus 200 ml), radiographic exposure (*see* Analysis 11.1), operative fracture of the femur (*see* Analysis 11.2), wound infection (*see* Analysis 11.3), post-operative complications (*see* Analysis 11.4), length of hospital stay (means: 10.2 versus 10.3 days), mortality in hospital (*see* Analysis 11.5), or time to independent walking (*see* Analysis 11.6).

Intramedullary nails (Gamma or PFN) versus the Medoff sliding plate

Miedel 2005 compared the Gamma nail with the Medoff sliding plate in 217 people and Ekstrom 2007 compared the proximal femoral nail (PFN) with the Medoff sliding plate in 203 people. Both studies included people with either an unstable trochanteric fracture or a subtrochanteric fracture.

Neither trial found a statistically significant difference between the two groups in the mean length of surgery (Miedel 2005: 61 versus 65 minutes; for Ekstrom 2007, *see* Analysis 12.1). Both trials reported statistically significantly lower mean blood losses in the intramedullary nail groups: Miedel 2005 (276 versus 402 ml, reported P < 0.01); the data for Ekstrom 2007 are shown in Analysis 12.2 (mean difference -297.00 ml, 95% CI -414.33 to -179.67). However, neither trial reported statistically significant differences in transfusion requirements: Miedel 2005, in terms of mean volume of blood transfused (864 versus 800 ml) and Ekstrom 2007, in the numbers having blood transfusions (no data provided). The mean radiographic screening time was two minutes greater in the PFN group of Ekstrom 2007 (*see* Analysis 12.3).

There were no statistically significant differences between groups for operative fracture of the femur (all four cases occurred in the nail groups: *see* Analysis 12.4), later fractures of the femur (none occurred: *see* Analysis 12.5), cut-out (*see* Analysis 12.6) or non-union (*see* Analysis 12.7). Opposite results were found for the two trials for reoperation (*see* Analysis 12.8): more reoperations, including three for excessive medial displacement of the femur, occurred in the Medoff group of Miedel 2005; conversely, Ekstrom 2007 reported a significantly higher reoperation rate in the PFN group. There were no statistically significant differences between the two groups for wound infection (*see* Analysis 12.9 and Analysis 12.10), wound haematoma (*see* Analysis 12.11), post-operative complications (*see* Analysis 12.12), or mortality at one year (*see* Analysis 12.13).

Miedel 2005 reported no significant differences between the two groups in pain, hip movement or walking ability scores assessed in the Charnley score for hip function, nor in activities of daily living (Katz) or health related quality of life scores (EuroQol) in those participants without severe cognitive dysfunction. Ekstrom 2007 reported, without supporting data, there was no statistically significant difference between the two groups in pain or return home at one year from injury. There were no statistically significant differences between the two groups of Ekstrom 2007 for four measures of mobility at one year (*see* Analysis 12.13, Analysis 12.14, Analysis 12.15 and Analysis 12.16).

Gamma nail versus the percutaneous compression plate (PCCP)

One trial (Varela-Egocheaga 2009) compared the Gamma 3 nail with the percutaneous compression plate (PCCP) in 80 people with trochanteric fractures.

This study reported no evidence of significant differences between groups for mean operation times (85.8 versus 86.5 minutes), fall in haemoglobin after surgery, or number of patients receiving transfusion (*see* Analysis 13.1). The need for analgesia after surgery was reported as similar for both groups.

Although all three cases of cut-out of the lag screw occurred in the Gamma nail group, the difference was not significant (*see* Analysis 13.2).

There were no significant differences between the two groups in post-operative complications (*see* Analysis 13.3), mean hospital stay (12.80 versus 11.77 days), the numbers of survivors discharged to intermediate care (*see* Analysis 13.4), in-hospital and one year mortality (*see* Analysis 13.5), or non-recovery of former mobility (*see* Analysis 13.6).

Femoral nails versus condylar screw or blade plates for lower trochanteric fractures

Two trials compared a femoral nail with either a dynamic condylar screw (DCS) plate (Sadowski 2002) or a 90-degree angled blade plate (Pelet 2001) for specific types of lower trochanteric fracture (AO type A3), including reversed fracture lines and transverse fractures at the level of the lesser trochanter. Since the fracture types, as well as the implants being compared, are similar these two trials are considered together, though presented as separate subcategories in the analyses. These fractures are uncommon and the trial populations in the two trials were small, with 39 participants in Sadowski 2002 and 26 participants in Pelet 2001.

In Sadowski 2002, the mean length of surgery for the proximal femoral nail (PFN) group was significantly less that of the DCS group (*see* Analysis 14.1: 82 versus 166 minutes; mean difference -84.00 minutes, 95% CI -115.71 to -52.29). A similar difference in mean operation times between the Gamma nail and blade plate groups was found in Pelet 2001 (86 versus 169 minutes, reported P < 0.05). Significantly fewer participants of the PFN group of Sadowski 2002 received blood transfusion (*see* Analysis 14.2: 11/20 versus 18/19; RR 0.58, 95% CI 0.39 to 0.88). The mean number of units of blood transfused was also less in the PFN group (1.5 versus 3.0 units). Pelet 2001 reported the mean operative blood loss was lower in the Gamma nail (550 versus 1150 ml, reported P < 0.05). The mean radiographic screening time was around four minutes for both implants of Sadowski 2002 (*see* Analysis 14.3).

There were no significant differences between groups for the individual outcomes of non-union (*see* Analysis 14.4), operative fracture of the femur (*see* Analysis 14.5), cut out (*see* Analysis 14.6), major reoperations (*see* Analysis 14.8: 0/33 versus 6/32; RR 0.07, 95% CI 0.00 to 1.22) or deep wound infection (*see* Analysis 14.9). However, this does not present the full picture, partly because of other major complications (e.g. plate breakage: *see* Analysis 14.7; three cases of avascular necrosis in the blade plate group of Pelet 2001) and mainly because reoperations were not performed/merited for other reasons: one person with cut-out in the DCS group of Sadowski 2002 was too ill and three patients in the plate group (two non-unions and one plate breakage) of Pelet 2001 had “low functional demand”. Five “major” reoperations in Sadowski 2002 involved implant removal and debridement and the sixth, implantation of a hip prosthesis. (Two “minor” reoperations undertaken to remove the distal locking screw in order to change the PFN to a dynamic construct in Sadowski 2002 were not included in Analysis 14.8.)

There were no significant differences between groups in post-operative complications (*see* Analysis 14.10 to Analysis 14.14). Length of hospital stay was significantly shorter in the PFN group of Sadowski 2002 (*see* Analysis 14.15: 13 versus 18 days; mean difference -5.00 days, 95% CI -8.60 to -1.40); and also less for the nail group of Pelet 2001: 33 versus 44 days. There was no evidence of significant differences between groups in mortality at one year (*see* Analysis 14.16), numbers of people with residual pain at one year (*see* Analysis 14.17), numbers in a nursing home (*see* Analysis 14.18; Analysis 14.19) or numbers requiring walking aids (*see* Analysis 14.20). Sadowski 2002 found no statistically significant differences between implants for pain, mobility and social function at one year for survivors without fracture healing complications.

Femoral nails versus condylar screw or blade plates for subtrochanteric fractures

Two trials compared a femoral nail with a fixed nail plate for subtrochanteric fractures. Lee 2007 compared the Russell-Taylor nail with the dynamic condylar screw (DCS) in 66 participants (11 others were excluded from the analysis); Rahme 2007 compared the proximal femoral nail (PFN) with a 95 degree blade plate in 60 participants. The results of the two trials are presented as separate subcategories in the analyses; no pooling was undertaken given visually and numerically significant heterogeneity.

There was no significant difference between the two groups in mean length of surgery for either trial: Lee 2007 (80 versus 74 minutes, see Analysis 15.1); Rahme 2007 (166 versus 171 minutes, reported P = 0.8). In Lee 2007, radiographic screening time for the nail group was significantly longer (*see* Analysis 15.2: 84.9 versus 65.5 seconds, mean difference 19.40 seconds, 95% CI 7.61 to 31.19); operative blood was significantly greater for the nail group (*see* Analysis 15.3: 543 ml versus 386 ml; mean difference 158 ml, 95% CI 59.40 to 256.60), and significantly more patients in the nail group received transfusion (*see* Analysis 15.4: 20/34 versus 8/32; RR 2.35, 95% CI 1.21 to 4.56). Rahme 2007 found no significant difference for the mean units of blood transfused (3.2 units versus 5.1 units; reported P = 0.4).

In Lee 2007, there was one case of non-union (coupled with implant breakage) and one case of secondary subcapital fracture (with cut-out) in the nail group versus one case of delayed/non-union in the plate group. All three cases required revision surgery. Significantly more patients in the blade plate group of Rahme 2007 had delayed/non-union (*see* Analysis 15.5); all eight cases of non-union in this group required revision surgery (*see* Analysis 15.6; RR 0.06, 95% CI 0.00 to 0.98).

There were no significant differences between groups for the wound infection (*see* Analysis 15.7), length of hospital stay (*see* Analysis 15.8; Rahme 2007: 25 versus 22 days), mortality (*see* Analysis 15.9; group allocations of five patients who died in hospital were not provided in Lee 2007), pain scores (*see* Analysis 15.10), or mobility score (*see* Analysis 15.11). Rahme 2007 reported no significant differences between the two groups in the general health assessed using the SF-36 at one year for 41 of the 60 trial participants.

DISCUSSION

Summary of main results

The use of the Gamma nail for stabilisation of stable or unstable trochanteric (AO type A1 and A2) fractures, although an attractive biomechanical concept, has been associated with a significantly increased risk of adverse events (intra-operative and later fracture around or below the implant). Of these two complications, later fracture is more devastating for the patient as it requires either major revision surgery or a prolonged period of traction and bed rest. Results from randomised trials comparing the Intramedullary Hip Screw (IMHS) with the SHS suggest that this implant has been associated with similar complications. There is insufficient evidence to say whether more recent development of the Gamma nail (Trochanteric Gamma nail), or of other designs, has overcome these adverse effects. It is, however, notable that the more recent trials evaluating newer intramedullary nails devices (Barton 2010: Long Gamma nail; Giraud 2005: Targon PF nail; Little 2008: Holland nail; Pajarinen 2005 and Papasimos 2005: PFN nail; Zou 2009: PNFA nail) have not reported either operative fracture and later femur fracture. This raises the possibility that there have been improvements to the design of the nails that now make the results for the incidence of fracture healing complications comparable to that of the SHS. But, despite the recent inclusion in the review of trials of the newer implants, overall pooled data from trial comparing femoral nails versus the sliding hip screw still point to an increased risk of one extra reoperation in every 50 patients (95% CI 1 in 33 to 1 in 100) with trochanteric fractures treated with an intramedullary nail.

There is no evidence of superiority of intramedullary devices in respect of fracture union, or cut-out of the fixation screw in the femoral head, a feature of both intramedullary and extramedullary devices.

Neither is there definite evidence for any difference in mortality nor, based on incomplete evidence, patient functional outcomes between the two types of implant.

For fractures occurring at the level of the lesser trochanter (AO type A3 - transverse and reverse obliquity fractures) types, the intramedullary nails were associated with better results, in comparison with extramedullary devices, for length of surgery, transfusion requirements, fixation failure rate, reoperation rate and hospital stay. Final outcome measures appeared to be similar between the two groups. Although based on results from two trials including a total of 65 participants, it appears likely that an intramedullary nail may give superior results to those of static plate fixation for these fractures.

Overall completeness and applicability of evidence

Lack of consistency and other deficiencies in the reporting of functional outcomes, and the limited use of validated measures are disappointing features of the body of trials included in this review. Inclusion of meaningful health related quality of life measures, and validated lower limb function scores have only recently begun to be reported in a few studies. Many of the outcomes reported have been intermediate, or concerned with process. The general adoption of an agreed set of outcomes for trials comparing the effectiveness of different implant designs would be a useful development.

We were unable to obtain adequate information from the included studies to make any distinction in outcome for unstable versus stable trochanteric fractures; nor separate data for those studies that included subtrochanteric fractures. This situation is unhelpful for clinical practice and a source of continuing frustration. Recognising this, in our next update we will consider the potential for presenting a summary of the evidence based on fracture type, backed up by some exploratory subgroup analyses. Intramedullary devices may have advantages for selected fracture types such as subtrochanteric fractures and trochanteric fractures with a reversed obliquity fracture line. Further studies are required to clarify if the Gamma nail, or another intramedullary nail, is superior for these fractures.

In evaluating the effectiveness of surgical implants, the experience and technique of the surgeon are believed to be important variables. For example, inadequate reaming and the use of excessive force on nail insertion have been implicated as the cause of femoral fracture. The problem of a learning curve for a new implant may jeopardise effective assessment within randomised trials. Thus it may be that some of the complications experienced with the Gamma nail would not have occurred had the surgeons been as familiar with the operative technique as they were with the SHS, the more established implant. Five trials (Benum 1994; Goldhagen 1994; Guyer 1991; Hoffman 1996; Utrilla 2005) specifically referred to a learning curve for Gamma nail insertion, and a further trial (O'Brien 1995) mentioned a performance bias with regards to surgery. However, our exploration of apparent surgical experience in subgroup analysis did not confirm any evidence of significant difference; it remains uncertain whether refining of operative technique and more rigorous training, or changes in implant design, will be the dominant factor in reducing the risk of later fracture of the femur. There were insufficient data to examine this issue for other comparisons.

Quality of the evidence

Forty-three studies (with data from 5750 participants) were included. With an average size of 134 participants, many individual studies lacked power to identify differences between the outcomes of the interventions compared.

Twenty-three of the 43 studies were considered at high risk of bias on the grounds of lack of experience of the surgeons with the newer technology, or disparate experiences of the operative procedures by the operating surgeons. Ten out of 43 trials were at high risk of bias on the grounds of inadequate concealment of allocation. Overall, 31 trials provided insufficient evidence to make a judgment on one or more of the three risk of bias items.

Despite these limitations, the evidence of increased risk of operative or later fracture of the femur associated with the use of intramedullary fixation of trochanteric fractures of the femur is consistent, and in view of the negligible heterogeneity amongst the studies, may be considered robust. A similar lack of heterogeneity supports the findings of a lack of differences between implants for other fracture healing complications and mortality. However, for other outcomes, in particular functional outcomes and morbidity, more limited and incomplete reporting of results and the lack of consistent and validated measures limit our ability to pool data and draw conclusions.

Potential biases in the review process

We searched widely, without imposing restrictions on language or publication status, but it remains possible that we may have missed some relevant studies. These may, for instance, have been unpublished trials, raising the possibility of publication bias, or not published in journals listed in the main databases. However, our scrutiny of other reviews and articles on this topic over the years has been reassuring in that these have not identified trials of which we had not been aware already. We have also contacted authors for clarification of methods and data as well as authors of ongoing trials. We anticipate, however, that unpublished data from early studies, which might have augmented some comparisons, may not now be available. The potential impact of these data on the review findings is now considerably less than for previous versions of the review. Our selection procedures were rigorous and both authors participated fully in all stages of the review.

AUTHORS' CONCLUSIONS

Implications for practice

In the management of trochanteric fractures (AO type A1 or A2), accumulated data from randomised controlled trials available up to April 2010 show no evidence of advantages to patients from the use of the Gamma nail, Intramedullary Hip Screw (IMHS) or other types of cephalocondylic intramedullary nails when compared with extramedullary implants of the sliding hip screw (SHS) design.

The use of the Gamma nail has been associated with a significantly increased risk of adverse events (intra-operative and later fracture around or below the implant), and results from randomised trials comparing the Intramedullary Hip Screw (IMHS) with the SHS suggest that this implant suffers from similar complications. While it is plausible that more recent designs of intramedullary nail might reduce the frequency of these specific complications, published evidence has not so far demonstrated either equivalence with, or superiority over the SHS in respect of these complications, or of functional advantage for patients. Despite the recent inclusion in the review of trials of the newer implants, pooled data still point to an increased risk of one extra reoperation in every 50 patients with trochanteric fractures treated with an intramedullary nail.

Intramedullary nails may have advantages over extramedullary fixation using fixed angle plates for more distal reverse and transverse transtrochanteric (AO type A3) fractures, and subtrochanteric fractures, although there is as yet insufficient evidence to confirm significant superiority over extramedullary devices.

Implications for research

Appropriate directions for future research include the role of intramedullary nails in subtrochanteric and reversed-obliquity trochanteric fractures. Design changes to different types of intramedullary nails, claimed to reduce the risk of post-operative fracture, should be tested versus the SHS in studies which record functional outcomes at a minimum of six months from surgery, are adequately powered to be capable of demonstrating both equivalence and difference, and meet the CONSORT criteria for design and reporting of non-pharmacological studies (Boutron 2008).

Particular deficiencies in the published literature are poor concealment of allocation, failure to report outcomes related to fracture type and limited information on participants who withdrew or for whom follow-up was incomplete, lack of blinded assessment of functional outcomes, limited reporting of functional outcomes and patient-derived quality of life measures, and insufficiently long follow-up. For trials comparing different surgical implants, the development of a benchmark set of outcomes, and concurrent economic evaluation are warranted.

ACKNOWLEDGEMENTS

We thank Dr Joanne Elliott for her help with the search for trials, Prof William Gillespie for substantial editorial contribution to this and previous updates, and to Mrs Lesley Gillespie for editorial contribution and search for trials in previous updates. We would also like to thank the following for helpful comments and corrections from editorial review of one or more of the review updates: Mrs Lindsey Elstub, Prof James Hutchison, Mr David Sands Johnson, Dr Vicki Livingstone, Prof Rajan Madhok, Prof Gordon Murray, Ms Kate Rowntree, Prof Marc Swiontkowski and Dr Janet Wale.

We thank Bal Appadu for assistance in the translation of Pelet 2001, Mireya Fernandez for the translation of Marques Lopez 2002 and Zhou Xiang for the translation of Liu 2008.

Helen Handoll's work on the first two versions of the review was supported by the Chief Scientist Office, Department of Health, The Scottish Office, UK.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Adams 2001

Methods	Randomised by sequentially numbered closed opaque sealed envelopes Surgical experience (*see* Footnotes): Yes (Claimed experience in both implants)
Participants	Orthopaedic hospital, UK. 400 participants Trochanteric proximal femoral fractures. Age: mean 81 years % male: 22% Number lost to follow-up: 0.3%
Interventions	Gamma intramedullary nail versus Richards Compression hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Operative blood loss Fall in haemoglobin Number of patients transfused Operative fracture of the femur Later fracture of the femur Cut-out of implant Detachment of the plate from the femur Reoperation Deep wound infection Superficial wound infection Deep vein thrombosis Mortality Use of walking aids Place of residence at follow up Harris hip score
Notes	Information of study supplied by trialists prior to publication

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Yes	"At admission, patients were randomized by a closed, opaque envelope method and were assigned to receive either..." Confirmed by Adams in 2001 that "the opaque envelopes were sequentially numbered" - and that there was concealment of alloca-

		tion.
Surgeons were experienced with trial operations?	Yes	"The surgeons were experienced in the insertion of both implants" Claim in draft report.

Ahrengart 1994

Methods	Randomised by consecutively opened sealed envelopes Surgical experience: Yes (Gamma nail: learning period before trial; SHS: routine)
Participants	Five orthopaedic hospitals, Sweden and Finland 548 participants Trochanteric and subtrochanteric fractures. But the 2002 report only included 492 trochanteric proximal femoral fractures. The baseline data and early results for 66 patients lost to follow-up were not reported. Age: median 80 years (range 32-99 years) % male: 29% Number lost to follow-up: 13%
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Transfusion Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (pseudarthrosis) Delayed healing Reoperation Wound infection Deep wound infection Superficial wound infection Thromboembolic complication (deep vein thrombosis, pulmonary embolism) Clinical complications (pneumonia) Length of hospital stay Shortening of leg Varus displacement Mortality at 6 months Pain at follow-up (persisting lateral hip pain) Return to pre-fracture residential status Failure to regain mobility Use of walking aids Length of skin incision

Notes	A report (2002) of the results for patients with trochanteric fractures from all five centres of this study is now available. It is however less comprehensive than the report, used in previous versions of this review, by Fornander et al 1994 which gave the results for two centres and 209 patients, including 19 with subtrochanteric fractures. Fornander also provided a pre-publication report and additional information for these two centres. Clarification on results and methods from Leif Ahrengart is pending (September 2003). Given the absence of information on 66 patients lost to follow-up in the five centre report and some lack of clarity or potential inconsistencies with the two centre study regarding surgical experience, trial inclusion criteria, outcome definitions and some results (i.e. there was one deep wound infection in the SHS group in Fornander 1994 but none in the five-centre report), we have kept the data from the two centre report.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"Randomization was achieved using sealed envelopes in numerical order before the patient was taken to the operating room." Insufficient mention of safeguards.
Surgeons were experienced with trial operations?	Yes	Surgery was done by various orthopaedic surgeons from junior residents to staff surgeons. However, an exclusion criterion was if the surgeon was unfamiliar with the Gamma nail technique. Fornander 1994 reports "The randomised series was preceded by a learning curve giving awareness of the technical details and potential difficulties or hazards of the Gamma method."

Barton 2010

Methods	Patients randomised using sealed envelopes prepared by an independent statistician. Surgical experience: Yes (All 32 surgeons familiar with both techniques)
Participants	Orthopaedic hospital, Bristol, UK 210 participants Unstable trochanteric proximal femoral fractures. Age: mean 83 years (range 42 to 99 years) % male: 21% Number lost to follow-up: not stated
Interventions	Long Gamma intramedullary nail versus sliding hip screw

Outcomes	Length of follow-up: 12 months Number of patients transfused Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Deep wound infection Reoperation Length of hospital stay Mortality Change in mobility score (measured on a 5 point ordinal scale) Change in residential status (measured on a 5 point ordinal scale) Mean quality adjusted life years
Notes	Significance testing was corrected for a significantly higher proportion of patients with a lower mini-mental score in the nail group.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"Randomization was carried out with use of sealed envelopes generated by a medical statistician." Once a patient was considered to be appropriate for inclusion, consent was obtained. An envelope was then selected and opened at a daily trauma meeting.
Allocation concealment?	Unclear	"Randomization was carried out with use of sealed envelopes generated by a medical statistician. Once a patient was considered to be appropriate for inclusion, consent was obtained. An envelope was then selected and opened at a daily trauma meeting." Inadequate mention of safeguards.
Surgeons were experienced with trial operations?	Yes	All 32 surgeons were experienced with both implants

Baumgaertner 1998

Methods	Randomised by sealed opaque envelopes opened sequentially Surgical experience: No (Gamma nail: familiar with IM nailing but not the Gamma nail; SHS routine; surgery by residents under supervision, 30 participating surgeons)
Participants	Two orthopaedic hospitals, USA 131 participants 135 trochanteric femoral fractures (4 of these were fractures which occurred several months later in the same patients) Excluded: pathological fractures. Age: mean 79 years (range 40-99 years) % male: 34% Number lost to follow-up: none
Interventions	Intramedullary hip screw versus sliding hip screw
Outcomes	Length of follow-up: mean 28 months (range 4-54 months) Length of surgery Operative blood loss Transfusion Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Wound haematoma Major medical complication Length of hospital stay Mortality Hip pain at follow-up Return to pre-fracture residence Patient mobility
Notes	Slight confusion with use of patient or fracture numbers in the trial report. Trialist explained that 4 patients had 2 fractures which were operated on several months apart (they were not bilateral fractures). These were considered separate operations and different cases for pre-op and operative data. Two of the 4 patients received both IMHS and SHS, and were excluded from longer term follow-up data but not mortality (where they were only counted once in the analysis). Curtin's abstract reporting early results for 70 patients shows the dangers of interim trial reports.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	”cards were shuffled“

Baumgaertner 1998 (*Continued*)

Allocation concealment?	Yes	”two hundred sealed opaque envelopes were randomly (cards were shuffled) assigned to either the IMHS or CHS, and numbered in sequential order, after enrolment in the study the next envelope was opened to reveal the device selected for the patient, no one was aware of the next upcoming device.
Surgeons were experienced with trial operations?	No	All participating attending surgeons had been using sliding hip screws ... before the start of the study, and although they were familiar with .. nailing, they previously had not used the intramedullary hip screw.

Benum 1994

Methods	Randomised by envelopes Surgical experience: No (Unknown for all centres but for sub-group from one centre, Aune et al 1993: Gamma nail: residents with varying experience of IM nailing (refers to learning curve); SHS: routine)
Participants	Orthopaedic hospitals, Norway 912 participants (interim results for 460) Trochanteric and subtrochanteric proximal femoral fractures. Age: not stated % male: not stated Number lost to follow-up: 21%
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant (fracture dislocation) Non-union (fracture healing) Reoperation Wound infection Deep vein thrombosis Pulmonary embolism Length of hospital stay Mortality Institutional stay Walking function

Notes	Data used in analyses tables are based on interim data for 460 patients published in 1992 in an abstract. Details for the completed trial of 912 patients were given in an another abstract published in 1994. The references Aune et al 1993 and Ekeland et al 1993 (x2) report the results of 378 patients recruited by one of the centres of the multicentre trial reported by Benum. Madsen et al 1996 refers to a subgroup from this centre. The follow up for these patients was 10 to 27 months. A later trial report by Madsen et al 1998 also includes a subgroup from this trial. A slightly modified Gamma nail was used (6 degree valgus angle). Not included in the analyses for reoperation are the final data for Benum 1994 (29/429 versus 7/467), which are consistent with the general result.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details.
Allocation concealment?	Unclear	"The randomization was done by drawing on among mixed envelopes containing information allocating the patient to either treatment." No mention of safeguards.
Surgeons were experienced with trial operations?	No	Report from one centre (Aune et al 1993) refers to treatment by "younger surgeons" and in consequence that "the learning curve becomes important".

Bridle 1991

Methods	"Randomised": method not specified Surgical experience: Yes (All 4 surgeons familiar with closed nailing techniques)
Participants	Orthopaedic hospital, UK 100 participants Trochanteric proximal femoral fractures. Age: mean 82 years (all over 60 years) % male: 16% Number lost to follow-up: 6%
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant

Bridle 1991 (*Continued)*

	Non-union Reoperation (incomplete data) Wound infection Wound haematoma Pneumonia Pressure sore Pulmonary embolism Any medical complication Length of hospital stay Shortening of femur (leg) (no information) Mortality Pain (no information) Eventual discharge residence Patient mobility
Notes	Some discrepancies between tables and text in report.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"randomly allocated"
Surgeons were experienced with trial operations?	Yes	"All the operations were performed by one of four senior surgeons, all experienced in closed nailing techniques."

Butt 1995

Methods	Quasi-randomised by even or odd numbered weeks Surgical experience: No (Unknown; same surgeons did both operations)
Participants	Orthopaedic hospital, UK 95 participants Trochanteric and subtrochanteric proximal femoral fractures. Age: mean 78.5 years (range 47-101 years) % male: 31% Number lost to follow-up: none
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 'to fracture union' (generally < 6 months) Length of surgery Blood loss Later fracture of the femur Cut-out of implant (incomplete data?)

	Non-union (time to union) Reoperation (total inferred) Wound infection Pneumonia Pressure sore Deep vein thrombosis Any medical complication Length of hospital stay Mortality
Notes	Gamma nail technique modified without apparent advantage after 37 Gamma nail patients.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	No	"Patients admitted on even-numbered weeks were treated with a DHS and patients admitted on odd-numbered weeks were treated with a gamma nail."
Allocation concealment?	No	As above.
Surgeons were experienced with trial operations?	No	Same surgeons did both operations, but no mention of experience and interim modification of surgical technique by the manufacturers.

Davis 1988

Methods	Randomised using numbered sealed opaque envelopes opened after patient assigned a trial numbers (via random numbers table) Surgical experience: No (unknown; operations performed by consultants or trainees)
Participants	Two orthopaedic hospitals, UK 230 participants Intertrochanteric proximal femoral fractures. Excluded: patients aged < 50, pathological and Pagets fractures. Age: mean 81 years % male: 17% Number lost to follow-up: none
Interventions	Kuntscher-Y nail versus sliding hip screw
Outcomes	Length of follow-up: 12 months Length of hospital stay

Davis 1988 (*Continued)*

	Length of hospital stay and convalescence Mortality (1 month and 6 months) Radiographic healing time Time to weight bearing Salvati and Wilson score Functional deficit Power and motion at hip Knee mobility Time till painless mobilisation
Notes	Hip nail used was described as an experimental device which is not available commercially. This outdated implant is now superseded by newer intramedullary nails that have improved instrumentation and the capacity for distal locking to reduce the risk of limb shortening.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"using random numbers table"
Allocation concealment?	Yes	"For each trial number, the name of the allocated fixation device was stored in an opaque sealed envelope which was opened only after a patient had been assigned this trial number."
Surgeons were experienced with trial operations?	No	No details: "Similar proportions of each operation were performed at the two hospitals, by consultants or trainee surgeons."

Dujardin 2001

Methods	Randomised: method not stated Surgical experience: Yes (All operations were undertaken by two surgeons with experience of the surgical technique; one surgeon did all the SHS operations and the other did all the nail operations)
Participants	Orthopaedic hospital, Rouen, France 60 participants Intertrochanteric proximal femoral fracture (stable and unstable fractures). Excluded: patients aged < 60, pathological, lower limb arteriopathy, fractures extending to the diaphysis, previous lesions of the hip, surgery after 2 days from fracture, cutaneous lesions, abnormal calcium or phosphorus metabolism and no consent. Age: mean 83.5 years % male: 20% Number lost to follow-up: not stated

Interventions	A mini-invasive static intramedullary nail versus sliding hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Mean units blood transfused Radiographic screening time Non-union; time to union Early post-op complications (infection, thromboembolism, further operation) Pneumonia Pressure sores All medical complications Length of hospital stay Varus deformity (reported for the nail group) Angular restoration Mortality Various aspects of hip function, including pain, power and mobility, were measured using the Salvati and Wilson score. Pain Failure to regain mobility Hip function Knee mobility
Notes	This experimental nail is not available commercially. The paper reported on radiographic measurements of anatomical restoration (cervicotrochanteric shortening and cervico-diaphyseal angle). However clinical outcomes such as leg shortening were not reported. The numbers of participants in each group returning home were not given. We have yet to find evidence of the multicentre study of this experimental implant, stated as underway in the report of this trial.

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"randomly allocated"
Surgeons were experienced with trial operations?	Yes	All operations were undertaken by two surgeons with experience of the surgical technique; one surgeon did all the SHS operations and the other did all the nail operations.

Ekstrom 2007

Methods	Randomised using numbered sealed envelopes Surgical experience: No (operations performed by 43 different surgeons, consultants or trainees)
Participants	Two orthopaedic hospitals, Sweden 210 participants (see Notes) Unstable intertrochanteric proximal femoral fractures (172) and subtrochanteric fractures (31). Excluded: people with stable trochanteric fractures, high energy trauma, pathological fractures, previous surgery to the proximal femur, daily steroids of more than 10 mg of prednisolone, ongoing chemotherapy, irradiation treatment, presence of degenerative osteoarthrosis of the injured hip. Age: mean 82 years (range 48 to 97 years) % male: 24% Number lost to follow-up: 25% (50 surviving patients were unable to attend the follow-up clinic at one year from injury)
Interventions	Proximal femoral nail versus the Medoff sliding plate (4 or 6 hole plate used in biaxial mode for trochanteric fractures and uni-axial mode for the subtrochanteric fractures)
Outcomes	Length of follow-up: 12 months Length of surgery Blood loss Radiographic screening time Cut-out of implant Non-union Operative fracture of the femur Later fracture of the femur Other fracture healing complications Reoperation Wound infection Wound haematoma Length of hospital stay Mortality Failure to return to pre-fracture residential status Pain Inability to walk 15 metres Inability to rise from the chair Inability to climb a curb Need to use walking aids Abductor strength
Notes	Of 210 randomised patients, 7 were excluded: 5 wrong fracture and 2 wrong treatment

Risk of bias

Item	Authors' judgement	Description

Ekstrom 2007 (*Continued)*

Adequate sequence generation?	Yes	"based on a computer generated list. Randomization was stratified according to trochanteric or subtrochanteric fractures."
Allocation concealment?	Unclear	Randomised "using consecutive numbered and sealed envelopes". Insufficient mention of safeguards.
Surgeons were experienced with trial operations?	No	"Surgery was undertaken by 43 different surgeons employed as regular staff at the two hospital" While "two senior consultations ... with extensive experience and familiar with both surgical methods, gave theoretical and practical instructions before the start of the study", this was considered not sufficient protection against performance bias.

Giraud 2005

Methods	Randomised using random numbers table Surgical experience: No (Unknown)
Participants	Orthopaedic hospital, Reims, France 60 participants Intertrochanteric proximal femoral fracture (stable and unstable fractures: AO 31-A1, A2 and A3). Age: mean 81/82 years (range 23 to 97) % male: 23% Number lost to follow-up: none
Interventions	Targon PF (proximal femoral) nail versus Dynamic hip screw
Outcomes	Length of follow-up: 3 months Length of surgery Blood loss Cut-out of implant Later fracture of the femur Reoperation Wound infection (none) Pneumonia (pulmonary congestion: "Pulmonaire") Deep vein thrombosis Length of hospital stay Mortality Time to walking Harris hip score
Notes	Extra information supplied by trialists.

Giraud 2005 *(Continued)*

Risk of bias		
Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	Random numbers table
Allocation concealment?	Unclear	No details of method
Surgeons were experienced with trial operations?	No	Unknown

Goldhagen 1994

Methods	Quasi-randomised according to patient's medical record number Surgical experience: No (Gamma nail: refers to significant learning curve. A "multiplicity of operating surgeons")
Participants	Orthopaedic hospital, USA 75 participants Trochanteric and subtrochanteric proximal femoral fractures. Age: median 76 years (range 28-91 years) % male: 30% Number lost to follow-up: none
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow-up: 6-9 months Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Length of hospital stay Mortality Pain at follow-up Non return to previous residence Impaired walking
Notes	Slight discrepancies in numbers Tables 1 and 2.

Risk of bias		
Item	**Authors' judgement**	**Description**

Goldhagen 1994 (*Continued)*

Adequate sequence generation?	No	" ..fractures ..were prospectively randomized into two groups according to their medical record number."
Allocation concealment?	No	" ..fractures ..were prospectively randomized into two groups according to their medical record number."
Surgeons were experienced with trial operations?	No	Refers to "a significant learning curve for the GN [Gamma nail]", and a "multiplicity of operating surgeons"

Guyer 1991

Methods	Quasi-randomised by alternating patients Surgical experience: No (Gamma nail: refers to inexperience of surgeons with implant)
Participants	Orthopaedic hospital, Switzerland 100 participants Trochanteric and subtrochanteric proximal femoral fractures. Age: mean 80 years % male: 15% Number lost to follow-up: 24%
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 12 weeks Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Deep wound infection Wound haematoma Length of hospital stay Shortening of leg (> 1 cm) Mortality Pain at follow-up (pain on walking) Non-return to previous residence Impaired walking
Notes	

Risk of bias

Item	**Authors' judgement**	**Description**

Guyer 1991 (*Continued)*

Adequate sequence generation?	No	"AO dynamic hip screws and gamma nails were implanted alternatively." Translation from German.
Allocation concealment?	No	Alternation
Surgeons were experienced with trial operations?	No	Refers to "the inexperience of the operators"

Hardy 1998

Methods	Quasi-randomised by even or odd medical record numbers Surgical experience: No (IMHS: refers to prolonged learning curve required for insertion; SHS routine; 2 senior operating surgeons, 3 junior attending surgeons)
Participants	University hospital, Belgium 100 participants (*see* Notes) Trochanteric proximal femoral fractures. Excluded: Patients aged <60, pathological fractures, incorrect anatomy, history of fracture or operation involving same limb. Age: mean 81 years % male: 23% Number lost to follow-up: none
Interventions	Intramedullary hip screw versus sliding hip screw
Outcomes	Length of follow-up: 1 year (see Notes) Length of surgery Operative blood loss Transfusion Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Wound infection Wound haematoma Pneumonia Thromboembolic complications (deep vein thrombosis, pulmonary embolism) Urinary tract infection Leg shortening Mortality Mid-thigh pain Hip pain at follow-up Eventual discharge residence Patient mobility Social function

Notes	Since a full report of the trial was published in 1998, a conference abstract presenting the results of 160 patients at 18 months follow up has become available (Hardy 1999). The limited results presented within Hardy 1999 require clarification and thus have not yet been included in this review.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	No	"prospectively randomized according into two treatment groups according to the medical record number"
Allocation concealment?	No	"prospectively randomized according into two treatment groups according to the medical record number"
Surgeons were experienced with trial operations?	No	"The different levels of experience of the ...operating surgeons and ... attending surgeons ..and the prolonged learning curve for insertion of intramedullary hip-screws may have also affected the operative time."

Harrington 2002

Methods	Randomised by opening sealed envelope on the admission ward Surgical experience: No (reference made to some surgeons who had only used the IMHS on bone model sessions)
Participants	Orthopaedic hospital, UK 102 participants Unstable trochanteric proximal femoral fractures. Excluded: Patients aged < 65 years, pathological fractures, previous fracture, other fracture. Age: mean 83 years % male: 21% Number lost to follow-up: not stated
Interventions	Intramedullary hip screw versus sliding hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Radiographic screening time Transfusion requirements Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union of fracture

	Other fracture healing complications Length of hospital stay Mortality Patient mobility Regain of pre-fracture living status
Notes	Additional information provided by authors

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"randomised on admission using a sealed envelope method". No indication of safeguards.
Surgeons were experienced with trial operations?	No	"Participating surgeons were required to familiarise themselves with the intramedullary implant and its insertion in supervised bone model sessions prior to using it in the clinical setting". This was considered insufficient for the purposes of the trial.

Haynes 1996

Methods	Randomisation by cards, but trial entry optional Surgical experience: No (Not clear. Gamma nail: prior experience with five insertions but speaks of unfamiliarity of the surgeons (various) with the treatment as a reason for exclusion (*see* Notes); SHS: routine)
Participants	Orthopaedic hospital, UK 50 participants Trochanteric or 'high' subtrochanteric proximal femoral fractures. Excluded: Previous non-consolidated femur fracture. Age: mean 80 years. % male: 28% Number lost to follow-up: none
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Operative fracture of femur* Cut-out

	Non-union* Reoperation Wound infection* Pneumonia* Pressure sore* Wound haematoma* Deep vein thrombosis* Pulmonary embolism* Length of hospital stay Shortening of leg* Mortality Pain at follow-up* Non return to previous residence Impaired walking * outcomes listed on data extraction form but not reported
Notes	Trial report was part of PhD research. Trial sponsored and part administered by Howmedica. Imbalance in numbers explained by unfamiliarity of surgeons with Gamma nail treatment. "This resulted in a temptation to omit the patient from the trial if a Gamma nail was drawn as treatment, from the randomisation cards". This was despite the efforts made to familiarise the surgeons to the Gamma nail: "a minimum of 5 Gamma Nails were then inserted by each surgeon before any cases were included in the trial"

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	No	"randomisation cards" However, the imbalance in numbers was explained by unfamiliarity of surgeons with Gamma nail treatment. "This resulted in a temptation to omit the patient from the trial if a Gamma nail was drawn as treatment, from the randomisation cards".
Surgeons were experienced with trial operations?	No	Surgical procedures were as recommended by the implant manufacturers, and "A minimum of 5 Gamma nails were then inserted by each surgeon before any cases were included in the trial". (SHS was routine). However, mention of unfamiliarity of the surgeons (various) with the treatment as a putative reason for post-randomisation exclusion (see above).

Hoffman 1996

Methods	Randomised by sealed opaque envelopes (a stiff card was used to prevent disclosure of allocation) Surgical experience: No (Gamma nail: refers to a longer learning curve than with SHS; 4 orthopaedic trainees, normal supervision)
Participants	Orthopaedic hospital, New Zealand 69 participants Trochanteric proximal femoral fractures. Patients aged over 50 years. Pathological fractures were excluded. Age: mean 81 years % male: 23% Number lost to follow-up: none
Interventions	Gamma intramedullary nail versus Ambi hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (time to union) Reoperation Wound infection Pneumonia Pressure sores Deep vein thrombosis Any medical complication Length of hospital stay Shortening of leg Mortality Pain at follow-up (unresolved pain in patients with intertrochanteric fractures) Non return to previous residence Patient mobility
Notes	Additional data received. There were 69 patients randomised but 2 died before surgery and were therefore not included. Updated recommendations on locking for Gamma nail insertion from manufacturers were implemented after patient 50.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"computer-generated blocked randomization"

Hoffman 1996 (*Continued)*

Allocation concealment?	Yes	"The treatment selections ... were sealed into opaque numbered envelopes that also contained a stiff card to further prevent disclosure of allocation."
Surgeons were experienced with trial operations?	No	Most operation carried out by "one of four orthopaedic trainees ... supervised as appropriate.." Referred to "longer learning curve for the Gamma nail may be the reason for the differences noted."

Hoffmann 1999

Methods	Randomised by sealed envelopes; blinding indicated Surgical experience: No (Operations by junior and senior staff)
Participants	Orthopaedic hospital, Germany 110 participants Trochanteric proximal femoral fractures. Excluded: pathological fractures. Age: mean 82 years % male: 20% Number lost to follow-up: 4%
Interventions	Intramedullary hip screw versus Sliding hip screw
Outcomes	Length of follow-up: mean 3.7 months Length of anaesthesia Length of surgery Operative blood loss Difference in haemoglobin Radiographic screening time Operative fracture of the femur Later fracture of the femur Loss of fracture reduction requiring reoperation Reoperation Wound infection Deep wound infection Wound haematoma Superficial wound infection Thromboembolic complication Clinical complications Length of acute hospital stay Shortening of leg (> 1 cm) Rotational deformity ('relevant') Mortality Pain (on walking) Return to pre-fracture residential status

Hoffmann 1999 (*Continued*)

	Impaired walking Merle d'Aubigne hip score
Notes	Article in German - limited translation only obtained.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Yes	referral to sealed envelopes and blinding indicated
Surgeons were experienced with trial operations?	No	Involved both senior and junior surgeons - tendency for more senior surgeons for the nail operations

Kukla 1997

Methods	Randomised using sealed envelopes Surgical experience: Yes (Senior surgeons experienced in both operations)
Participants	Orthopaedic hospital, Austria 120 participants Trochanteric proximal femoral fractures. Excluded: Patients aged < 60 years, pathological fractures, multiple injury patients. Age: mean 83 years (range 60-99 years) % male: 15% Number lost to follow-up: 3 (3%)
Interventions	Gamma intramedullary nail versus Sliding hip screw
Outcomes	Length of follow-up: 6 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Wound infection Deep wound infection Wound haematoma Pneumonia Deep vein thrombosis Pulmonary embolism Any medical complication

	Length of hospital stay Shortening of leg (> 2 cm) Mortality Non-return to previous residence Impaired walking
Notes	Additional information received from authors included draft report prior to publication.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	"random permutation" letter from trial investigator
Allocation concealment?	Unclear	"Allocation to the 2 groups was achieved by randomized, sealed envelopes". No indication of safeguards.
Surgeons were experienced with trial operations?	Yes	"Senior surgeons who, having operated on at least 80 cases each, were experienced in the use of both devices.."

Kuwabara 1998

Methods	Randomised trial: method not stated Surgical experience: No (unknown)
Participants	Orthopaedic hospital, Japan 43 participants Trochanteric proximal femoral fractures. Excluded: patients < 65 years. Age: mean 81 years % male: 28% Number lost to follow-up: not known
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow-up: mean 6 months (5.7 and 6.5 months respectively for the two groups) Length of surgery Operative blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Wound infection Inversion deformity Eversion deformity

Kuwabara 1998 (*Continued*)

	Loss in mobility and use of walking aids
Notes	Trial published in Japanese. Only a limited translation obtained.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	"randomized"
Allocation concealment?	Unclear	"randomized"
Surgeons were experienced with trial operations?	Unclear	Not known

Lee 2007

Methods	Quasi-randomised by even or odd medical record numbers Surgical experience: Yes: referred to extensive experience with devices
Participants	Orthopaedic hospital, Taoyuan, Taiwan 77 participants* Subtrochanteric proximal femoral fractures (all unstable fracture pattern with comminution, Seinsheimer classification type III, IV and V) Excluded: patients > 55 years. Age (of 66): mean 36 years (range 19 to 54) % male: 77% Number lost to follow-up: 6/77 (8%); + 5 deaths in hospital from severe but not orthopaedic trauma
Interventions	Russell-Taylor reconstruction intramedullary nail versus Dynamic condylar screw (DCS)
Outcomes	Length of follow-up: mean 28.1 months (24 months minimum) Length of surgery Operative blood loss Radiographic screening time Number of patient given transfusion Mean units of blood transfused Re-fracture around the implant Non-union/delayed union of the fracture Reoperation Superficial wound infection Deep wound infection Mean time to fracture union Length of hospital stay Total degrees of hip movements Mortality Mobility score

	Pain
Notes	* 77 patients met inclusion criteria but 11 excluded from subsequently, either lost to follow-up or died in hospital. Plate fixation involved a bridging plate method, in which small skin incisions are made and the plate passed along the femur without exposing the fracture.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	No	Quasi-randomised: "Patients were randomized according to their medical record number"
Allocation concealment?	No	Quasi-randomised with no concealment of allocation: "34 patients with an even medical record number were treated by the RTRN and 32 patients with an odd medical record number were treated by the DCS."
Surgeons were experienced with trial operations?	Yes	"They [the senior surgeons] had extensive experience using femoral nailing with a RT-TRN and biologic plating with a DCS."

Leung 1992

Methods	Quasi-randomised by alternating patients Surgical experience: No (Imbalance in experience (*see* Notes): Gamma nail: mostly by one experienced surgeon; SHS: by less experienced surgeons)
Participants	Orthopaedic hospitals, Hong Kong 225 participants 226 trochanteric proximal femoral fractures. Excluded: Patients aged <65 years. Age: mean 80 years % male: 30% (excluding deaths) Number lost to follow-up: none
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: mean 7 months Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur

	Cut-out of implant Non-union (fracture healing) Reoperation Deep wound infection Pneumonia Any medical complication (incomplete) Length of hospital stay (mixed location) External rotational deformity Shortening of leg (> 2 cm) Varus displacement (> 10 degrees) Mortality Pain at follow-up (pain in hip and pain in thigh) Impaired walking
Notes	The 40 patients who died within 6 months of surgery were not included in the full assessment of results. Further information obtained from author. Most of the Gamma nail operations were performed by one senior surgeon with a special interest in intramedullary nailing, whilst the sliding hip screw operations were performed by a number of less experienced surgeons.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	No	Alternation: "fixation was randomly assigned according to the sequence of admission"
Allocation concealment?	No	Alternation: "fixation was randomly assigned according to the sequence of admission"
Surgeons were experienced with trial operations?	No	Serious bias. Most of the Gamma nail operations were performed by one senior surgeon with a special interest in intramedullary nailing, whilst the sliding hip screw operations were performed by a number of less experienced surgeons.

Little 2008

Methods	Randomised trial: use of a computer Surgical experience: claimed but also referral to possible influenced of learning curve on some outcomes
Participants	Orthopaedic hospital, Chertsey, United Kingdom 190 participants Trochanteric proximal femoral fractures Excluded: patients with subtrochanteric fractures

Little 2008 *(Continued)*

	Age: mean 83 years (range: 50 to 102) % male: 15% Number lost to follow-up: 0%
Interventions	Long Holland intramedullary nail versus sliding hip screw (SHS)
Outcomes	Length of follow-up: mean 12 months Length of surgery Operative blood loss Radiographic screening time Number of patients transfused Cut-out of the implant Re-fracture around the implant Reoperation Superficial wound infection Deep wound infection Pneumonia Deep vein thrombosis Pulmonary embolism Transient Ischaemic attack Mortality Failure to regain mobility Mobility score Days till mobilisation
Notes	

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"Patients were allocated a sequential study number and were randomised by computer to be treated with a DHS or a Holland nail."
Allocation concealment?	Unclear	"randomised by computer" but no mention of safeguards
Surgeons were experienced with trial operations?	Unclear	"Each procedure was carried out by a specialist registrar under supervision or by a consultant who was familiar with both procedures." However, the report suggested that the longer operating and radiation times in the Holland nail group "may be a function of the learning curve in its use".

Marques Lopez 2002

Methods	Quasi-randomised according to medical record number Surgical experience: No (variable)
Participants	Orthopaedic hospital, Barcelona, Spain 103 participants Trochanteric proximal femoral fractures. Age: mean 84 years % male: 35% Number lost to follow-up: not stated
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Post-operative transfusion Change in haematocrit Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Reoperation Wound infection Wound haematoma Deep vein thrombosis Pneumonia Pressure sores Mortality Mobility Mean time to fracture consolidation
Notes	The outcome of post-operative transfusion was inadequately defined. Mortality at one year was only given as percentages; there was inadequate information to determine if all randomised patients were included in the calculation of these percentages.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	No	Quasi-randomised according to medical record number
Allocation concealment?	No	Quasi-randomised according to medical record number
Surgeons were experienced with trial operations?	No	Various levels of operating experience

Mehdi 2000

Methods	Randomised by sealed envelopes. Surgical experience: No (Reference made to relative inexperience with IMHS at start of trial)
Participants	Orthopaedic hospital, UK 180 participants Extracapsular proximal femoral fractures. Age: mean 76 years % male: unknown Number lost to follow-up: 19%
Interventions	Intramedullary hip screw versus sliding hip screw
Outcomes	Length of follow-up: minimum 6 months (mean 13 months, range 6 to 36 months) Length of surgery Operative blood loss Operative fracture of the femur Later fracture of femur (none) Cut-out of implant Peri-operative complication Fracture reduction Wound infection (superficial and deep) Mortality Mobility Harris hip scores
Notes	Abstract only published. Unpublished report made available by trialist. Because of the large range of final follow-up times and high and unequal losses to follow-up, we decided against presenting final follow-up results (mortality, later fracture and mobility) in the review. Two cases of IMHS required conversion to SHS fixation due to "excessive bowing".

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"Patients ... were randomised .. at the daily trauma meeting by drawing sealed envelopes." No mention of safeguards.
Surgeons were experienced with trial operations?	Unclear	"A three-month period of familiarisation with the IMHS, prior to the trial, was undertaken to avoid bias. Despite that, all surgeons were more familiar with the Richards Classic Hip Screw..."

Michos 2001

Methods	Randomised: method not stated Surgical experience: No (Unknown)
Participants	Orthopaedic hospital, Greece 52 participants Trochanteric proximal femoral fractures. Some may have had subtrochanteric extension. Age: mean 78.5 years % male: unknown Number lost to follow-up: not known
Interventions	Gamma intramedullary nail (“Trochanteric Gamma Nail” used if no subtrochanteric extension) versus sliding hip screw
Outcomes	Length of follow-up: 3 to 6 months Operative blood loss Later fracture of the femur Cut-out of implant Non-union Plate detachment Mortality (peri-operative)
Notes	Abstract only.

Risk of bias

Item	Authors’ judgement	Description
Adequate sequence generation?	Unclear	No details: “randomly allocated”
Allocation concealment?	Unclear	No details: “randomly allocated”
Surgeons were experienced with trial operations?	Unclear	No information

Miedel 2005

Methods	Randomised by sealed envelopes Surgical experience: No (Half of the operations in each group were by consultant orthopaedic surgeons)
Participants	Orthopaedic hospital, Stockholm, Sweden 217 participants Unstable trochanteric and subtrochanteric proximal femoral fractures. Age: mean 84 years (range 65 to 99 years) % male: 19% Number lost to follow-up: 6 (3%) (at 12 months)

Miedel 2005 *(Continued)*

Interventions	Gamma intramedullary nail versus Medoff sliding plate (eight hole Medoff plate used in biaxial dynamisation mode)
Outcomes	Length of follow-up: 12 months Length of surgery Operative blood loss Post-operative transfusion Operative fracture of the femur Technical failure Later fracture of the femur Cut-out of implant Displacement (medialisation of the femur requiring surgery) Reoperation Wound infection (superficial and deep) Severe medical complications (cardiac, pulmonary, thromboembolic or cerebrovascular) Length of hospital stay Discharge location Mortality Mobility Pain Hip function Activities of daily living Health related quality of life
Notes	Details of the reoperations removed from the text in the update (issue 1, 2008): All three reoperations, involving total hip replacement, in the Gamma group were for cut-out. Nine reoperations were required in the Medoff group, two (one Girdlestone arthroplasty and one multiple debridements) for sepsis, three (one Girdlestone arthroplasty and two total hip replacement) for cut-out, three (two to intramedullary nails and one to a fixed nail plate with subsequent total hip replacement) for femur displacement (medialisation), and one removal of the Medoff plate due to pain with later revision to a total hip replacement.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"The patients were randomised (sealed-envelope system)"
Surgeons were experienced with trial operations?	No	Only half of the operations in each group "were performed by consultant orthopaedic surgeons".

Mott 1993

Methods	Randomised using computer-generated random numbers table Surgical experience: No
Participants	Three orthopaedic hospitals, Detroit, USA. 69 participants Trochanteric proximal femoral fractures. Age: mean 76 years (range 19 to 99 years) % male: 42% Number lost to follow-up: not stated
Interventions	Gamma intramedullary nail versus sliding hip screw
Outcomes	Length of follow-up: not stated Length of surgery Operative blood loss Blood transfusion Operative fracture of the femur Later fracture of the femur Cut-out of implant Reoperation Deep wound infection Superficial wound infection Wound haematoma Deep vein thrombosis Myocardial infarction Pneumonia Urinary tract infection Mortality (1 week)
Notes	Trial information supplied by trialists

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Computer-generated random numbers table
Allocation concealment?	Unclear	No information on allocation process
Surgeons were experienced with trial operations?	No	There was variation in the experience in the three hospitals, with a "continual learning curve" in hospital A, a "one-time" learning curve in hospital B, and no learning curve required in hospital C.

O’Brien 1995

Methods	Blinded randomisation of patients using envelopes Surgical experience: No (refers to “performance bias” during operation)
Participants	Orthopaedic hospital, Canada. 101 participants 102 trochanteric proximal femoral fractures. Age: mean 80 years (range 39 to 95 years) % male: 26% Number lost to follow-up: 18%
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: average 52 weeks (range 11 to 82 weeks) Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (time to union) Reoperation Wound infection Deep wound infection Wound haematoma Pneumonia Pressure sores Pulmonary embolism Any medical complication Length of hospital stay Mortality Pain at follow-up Loss of independence Loss in mobility
Notes	Additional information received from authors. The mortality rate may be higher than that reported because of the number of patients lost to follow up. The number of patients that may have died in the follow-up period is unclear.

Risk of bias

Item	**Authors’ judgement**	**Description**
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Yes	“randomly allocated by blind envelope selection”

O'Brien 1995 (*Continued)*

Surgeons were experienced with trial operations?	No	Referral to possible "performance bias" during operation.

Ovesen 2006

Methods	Randomised by consecutively opened sealed opaque envelopes (computer generated sequence) Surgical experience: No (operations by surgical team on call: 49 surgeons participated in trial)
Participants	Orthopaedic hospital, Odense, Denmark 150 participants with 151 fractures (see Notes) Trochanteric fractures. Age: mean 79 years (range not stated) % male: 28% Number lost to follow-up: 17%
Interventions	Trochanteric Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Blood loss Transfusion Operative fracture of the femur (none) Later fracture of the femur Cut-out of implant Non-union (none) Reoperation Wound infection Medical complications (none) Length of hospital stay Mortality at 12 months Use of walking aids at discharge and 4 months
Notes	Five cases were excluded post-randomisation: 2 wrong diagnosis and 3 transferred out of the hospital catchment area. Extra information supplied by trialists. There were three cases of redislocation of the fracture in which there was major loss of reduction and/or implant position. These cases were included as cases of cut-out.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"computer generated" (communication from trialist)

Ovesen 2006 (*Continued*)

Allocation concealment?	Yes	"patients were randomized by consecutive drawing of opaque envelopes". These were confirmed as sealed by the trialist.
Surgeons were experienced with trial operations?	No	Over two thirds of operations done by residents: 49 surgeons participated in trial

Pahlpatz 1993

Methods	Randomised: method not stated Surgical experience: No (unknown: operations by surgical residents with assistance of staff member as required)
Participants	Orthopaedic hospital, Netherlands 113 participants Trochanteric proximal femoral fractures. Age: mean and range - not stated % male: not stated Number lost to follow-up: not stated
Interventions	Gamma intramedullary nail versus sliding hip screw
Outcomes	Length of follow-up: 6 months minimum Mortality Failure to regain residential status
Notes	The paper states these are preliminary results of the study and only reports on two outcome measures. No additional results have since been made available.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"Within each group [stable trochanteric, unstable trochanteric; subtrochanteric fractures] the patients were non-selectively randomised ..."
Surgeons were experienced with trial operations?	No	"Most of the procedures were done by surgical residents ..., if necessary with the assistance of a member of the staff."

Pajarinen 2005

Methods	Randomised by numbered sealed opaque envelopes; Surgical experience: Yes (Trialist confirmed all surgeons were experienced in both procedures)
Participants	Orthopaedic hospital, Helsinki, Finland 108 participants Trochanteric proximal femoral fracture. Age: mean 81 years % male: 25% Number lost to follow-up: 15 (14%)
Interventions	Proximal femoral nail versus Dynamic hip screw
Outcomes	Length of follow-up: 4 months Length of surgery Blood loss Units of blood transfused Later fracture of femur Cut-out Failure of fixation (redisplacement) Reoperation Superficial wound infection Deep wound infection Deep vein thrombosis Femoral neck and shaft shortening on X-ray Length of hospital stay Mortality Failure to regain pre-fracture residential status Non recovery of previous mobility
Notes	Additional information supplied by trialists, who also confirmed that the participants of a separately reported radiological study were also ("for most parts of the series") in the trial.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"strict randomisation"
Allocation concealment?	Yes	"The mode of treatment was determined by strict randomisation, using sealed envelopes." Trialist conformed that "it was impossible to see the number through the envelope".
Surgeons were experienced with trial operations?	Yes	Trialist confirmed that "both procedures are standard procedures at our clinic" and that "our surgeons are very experienced".

Papasimos 2005

Methods	Randomised trial: method not stated Surgical experience: No (unknown)
Participants	Orthopaedic hospital, Patras Hellas, Greece 141 participants Unstable trochanteric proximal femoral fracture (see Notes) Age: mean 81 years % male: 39% Number lost to follow-up (of 141): 11 (8%)
Interventions	Proximal femoral nail (PFN) versus Trochanteric Gamma nail versus sliding hip screw. 11 or 12 mm diameter PFN with distal locking in 37 out of 40 participants. 135 degree Trochanteric Gamma nail with 17 mm proximal diameter and 11 mm distal diameter and distal locking in all participants.
Outcomes	Length of follow-up: mean 12 months Length of surgery Operative blood loss Radiographic screening time Operative fracture (some of greater trochanter) Cut-out of implant Later fracture of the femur Non-union Reoperation Superficial wound infection Haematoma Medical complications Chest infection Pneumonia Mental disturbances Deep vein thrombosis Pulmonary embolism Urinary infection Length of hospital stay Time to fracture consolidation Function: Salvati and Wilson score
Notes	There were 141 people randomised into this trial but the intervention groups for the 10 participants who died before one year and the 11 who were lost to follow-up were not identified. Four of the five re-operations in the PFN group resulted from the 'Z effect', which describes the cutting out of one of the PFN proximal pins with backing out of the other pin.

Risk of bias

Item	Authors' judgement	Description

Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"Patients were... strictly randomised"
Surgeons were experienced with trial operations?	No	Four surgeons involved and statement that there was "good enough experience with each implant in the clinic". However, also referral in the Discusion of "our immature learning curve".

Park 1998

Methods	Quasi-randomised according to medical record number Surgical experience: No (unknown)
Participants	University hospital, Korea 60 participants Intertrochanteric femoral fracture. Age: mean 73 years (all over 60 years) % male: 40% Number lost to follow-up: none
Interventions	Gamma AP (Asia-Pacific) intramedullary nail versus Compression hip screw
Outcomes	Length of follow-up: mean 18.5 months (range 12 to 31 months) Length of surgery Blood loss Operative fracture of femur (none) Later fracture of femur (greater trochanter) Cut-out of implant Non-union (time to union) Wound infection Varus deformity Patient mobility
Notes	The Gamma AP nail is a modification of the standard Gamma intramedullary nail for use in oriental patients. A request to the trialists for further information including mortality data has been sent.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	No	"prospectively randomised into two groups based on their medical record numbers"

Park 1998 (*Continued)*

Allocation concealment?	No	"prospectively randomised into two groups based on their medical record numbers"
Surgeons were experienced with trial operations?	Unclear	No information.

Pelet 2001

Methods	Randomised by the drawing of lots. Those with an even number drawn received one implant and those with an odd number the other implant. Surgical experience: No (More experience with Gamma nail)
Participants	Orthopaedic hospital, Lausanne, Switzerland 26 participants Trochanteric proximal femoral fractures, classified by the system of Kyle as type IV. These are equivalent to type A3 (AO classification): reversed and transverse fracture lines at the level of the lesser trochanter. Age: mean 71 years (range 21 to 96 years) % male: 35% Number lost to follow-up: none
Interventions	Gamma nail versus the 90 degree angled blade plate
Outcomes	Length of follow-up: 12 months Length of surgery Operative blood loss Operative fracture of the femur Cut-out Non-union (and time to consolidation) Avascular necrosis Implant failure Reoperation Wound infection Pulmonary embolism Cardiac failure All medical complications Length of hospital stay External rotation deformity Hip flexion Mortality Pain at follow-up Use of walking aids Time to start of weight bearing Time to full weight bearing
Notes	Article in French

Risk of bias

Pelet 2001 (*Continued)*

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Random numbers method
Allocation concealment?	Unclear	Trialist stated that randomisation was "fully blinded", but gave no details of method other than the drawing of lots.
Surgeons were experienced with trial operations?	No	In correspondence, trialist indicated that there "may be more experience in gamma as plate"

Radford 1993

Methods	"Randomised": method not stated Surgical experience: Yes (Gamma nail: personal training and 2 operations before trial; SHS routine; registrar grade and above)
Participants	Orthopaedic hospital, UK 200 participants Trochanteric proximal femoral fractures. Age: mean 80 years (range 60 to 97 years) % male: 22% Number lost to follow-up: not stated
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Wound infection Deep wound infection Deep vein thrombosis Length of hospital stay Mortality Transfer to long term care Mobility level
Notes	
Risk of bias	

Radford 1993 *(Continued)*

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	"randomly assigned"
Allocation concealment?	Unclear	"randomly assigned"
Surgeons were experienced with trial operations?	Yes	"only surgeons of registrar grade and above .. took part in trial. They were already experienced in the use of the DHS and intramedullary nailing, and were personally instructed in the operative technique for the Gamma nail. ...The first two Gamma nail operations performed by each surgeon were not included in the trial."

Rahme 2007

Methods	"Randomised": method not stated Surgical experience: No (unknown)
Participants	Orthopaedic hospitals, Sydney, Australia 60 participants Subtrochanteric proximal femoral fractures, all types Age (of 58): mean 70 years % male: 43% Number lost to follow-up: not stated (2 were protocol violations)
Interventions	Proximal femoral nail (PFN) versus 95 degree blade plate
Outcomes	Length of follow-up: 12 months Length of surgery Operative blood loss Mean units of blood transfused Non-union and delayed union Reoperation Wound infection Length of hospital stay Mortality General health (SF-36)
Notes	

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	"randomised": no details

Rahme 2007 (*Continued*)

Allocation concealment?	Unclear	"randomised": no details
Surgeons were experienced with trial operations?	No	No information

Sadowski 2002

Methods	Randomised using computer generated randomised numbers Surgical experience: Yes (All surgeons had performed at least eight of each operation before the study)
Participants	Orthopaedic hospital, Geneva, Switzerland 39 participants Trochanteric proximal femoral fractures, type A3 (AO classification): reversed and transverse fracture lines at the level of the lesser trochanter. Age: mean 79 years % male: 31% Number lost to follow-up: none (one patient was unable to attend clinic so had follow-up by phone)
Interventions	Proximal femoral nail versus the Dynamic condylar screw
Outcomes	Length of follow-up: 12 months Length of surgery Operative blood loss Mean units transfused Number of patients transfused Radiographic screening time Cut-out Non-union (and time to consolidation) Implant failure Reoperation Wound infection Pneumonia Pressure sores Deep vein thrombosis Pulmonary embolism Urinary infection Cardiac failure/infarction All medical complications Mortality Pain at follow-up Social function Transfer to long term care Mobility level
Notes	Additional information supplied by authors This trial was concurrent with Saudan 2002

Sadowski 2002 (*Continued)*

Risk of bias		
Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Yes	"No patient refused randomization, which was accomplished with use of computer-generated random numbers."
Allocation concealment?	Unclear	"computer-generated random numbers". No mention of safeguards.
Surgeons were experienced with trial operations?	Yes	Information from trialist: "All the surgeons involved in this study had performed an average of eight procedures with the PFN prior to the initiation of the randomized clinical trial."of each operation before the study)

Saudan 2002

Methods	Randomised using computer generated randomised numbers Surgical experience: Yes (all surgeons had performed at least eight of each operation before the study)
Participants	Orthopaedic hospital, Geneva, Switzerland 206 participants Trochanteric proximal femoral fractures, types A1 and A2 (AO classification). Age: mean 83 years % male: 22% Number lost to follow-up: 4%
Interventions	Proximal femoral nail versus Dynamic hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Operative blood loss Mean units transfused Number of patients transfused Radiographic screening time Cut-out Non-union (and time to consolidation) Implant failure Reoperation Wound infection Pneumonia Pressure sores Deep vein thrombosis

Saudan 2002 *(Continued)*

	Pulmonary embolism Urinary infection Cardiac failure/infarction All medical complications Mortality Pain at follow-up Social function Transfer to long term care Mobility level
Notes	Additional information supplied by authors This trial was concurrent with Sadowski 2002.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"No patient refused randomization, which was accomplished with use of computer-generated random numbers."
Allocation concealment?	Unclear	"computer-generated random numbers". No mention of safeguards.
Surgeons were experienced with trial operations?	Yes	Information from trialist: "All the surgeons involved in this study had performed an average of eight procedures with the PFN prior to the initiation of the randomized clinical trial."of each operation before the study)

Utrilla 2005

Methods	Randomised by sealed envelopes, order based on sequence of admission Surgical experience: Yes (3 prior operations for the nail)
Participants	Orthopaedic hospital, Alicante, Spain 210 participants Trochanteric proximal femoral fractures. No subtrochanteric fractures Age: mean 80 years (range 65 to 104 years) % male: 31% Number lost to follow-up: 7 (3.3%)
Interventions	Gamma intramedullary nail (Trochanteric Gamma Nail version) versus sliding hip screw
Outcomes	Length of follow-up: 12 months Length of surgery Blood transfusion

Utrilla 2005 (*Continued)*

	Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Reoperation Deep wound sepsis Local wound healing complications Deep vein thrombosis Shortening Hip flexion Mobility Pain (thigh pain) Mortality at one year	
Notes		

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	"The patients were randomized for treatment into 2 groups based on sequence of admission, sealed envelopes were opened before the surgeon attempted a closed reduction of the fracture." No mention of safeguards
Surgeons were experienced with trial operations?	Yes	"Four surgeons experienced in the standard Gamma nail did all the operations; however, the first 3 TGN operations performed by the surgeons were not included in the study and served as the learning curve for the new instrumentation."

Varela-Egocheaga 2009

Methods	Randomised using random numbers table Surgical experience: likely, referral to prior 'learning curve' period.
Participants	Orthopaedic hospital, Gijon, Spain 80 participants Trochanteric proximal femoral fractures. No subtrochanteric fractures Age: mean 82 years (range not stated) % male: 21% Number lost to follow-up: 1 (1.25%) (*see* Notes)

Varela-Egocheaga 2009 (*Continued)*

Interventions	Gamma 3 intramedullary nail versus the Percutaneous compression plate (PCCP)
Outcomes	Length of follow-up: 12 months Length of surgery Blood transfusion Fall in haemoglobin Cut-out of implant Confusion Stroke Congestive cardiac failure Pneumonia Genitourinary infection Length of hospital stay Mortality at one year Discharge to intermediate care Post-operative analgesia (duration and dose of Metamizol) Failure to regain mobility
Notes	Number of patients lost to follow-up inferred from mobility data.

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	"randomized using a table of randomized numbers"
Allocation concealment?	Unclear	No details
Surgeons were experienced with trial operations?	Yes	Referral to prior 'learning curve' period before start of the trial

Verettas 2010

Methods	Quasi-randomised by alternating patients to the two groups Surgical experience: possible - claimed in the discussion that "surgeons had previous experience of the use of these implants.", but there was a change in nail forced on the surgeon's midway through the trial.
Participants	Orthopaedic hospital, Alexandroupolis, Greece 120 participants Unstable trochanteric proximal femoral fractures. Age: mean 80 years (range: not stated) % male: 30% Number lost to follow-up: not stated (but potential post-randomisation exclusions in those not operated before 24 hours)
Interventions	Intramedullary nail (38 Gamma nail, 22 Endovis BA nail) versus Dynamic hip screw

Outcomes	Length of follow-up: duration of hospital stay (mean 10 days) Length of surgery Blood loss Radiographic screening time Number of patients transfused Operative fracture of the femur Superficial wound infection Deep vein thrombosis ("immediate post-operative") Cardiovascular complication ("immediate post-operative") Neurologic complication/ delirium ("immediate post-operative") Respiratory complication ("immediate post-operative") Haematocrit Oxygen saturation and pressure Mental test score Length of hospital stay Days to independent walking Mortality (in hospital) Pain score
Notes	The explanation from the lead author for the change in nail was that it resulted from a change of supplies policy at the hospital.

Risk of bias

Item	**Authors' judgement**	**Description**
Adequate sequence generation?	No	"The patients were allocated to each group alternatively on their admission."
Allocation concealment?	No	"The patients were allocated to each group alternatively on their admission." (Informed consent was obtained before inclusion.)
Surgeons were experienced with trial operations?	Unclear	"In our study the operating time was similar in both groups, possibly because the surgeons had previous experience of the use of these implants." (Statement in the Discussion.) However, a change in nail was forced on the trialists during the trial.

Zou 2009

Methods	Randomised trial, method not stated Surgical experience: No (unknown)
Participants	Orthopaedic hospital, Suzhou, Jiangsu, China 121 participants Trochanteric proximal femoral fractures. Age: mean 65 years (range: not stated) % male: 22% Number lost to follow-up: not stated
Interventions	Proximal femoral nail antirotation (PFNA) versus Dynamic hip screw
Outcomes	Length of follow-up: one year Length of surgery Operative blood loss Radiographic screening time Cut-out of the implant Later fracture of the femur Non-union of the fracture Implant breakage Reoperation Superficial wound infection Deep wound infection Deep vein thrombosis Length of hospital stay Salvati and Wilson Hip score at one year
Notes	

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Unclear	No details
Allocation concealment?	Unclear	No details: "consecutive patients ... were randomised"
Surgeons were experienced with trial operations?	Unclear	Not stated

"Surgical experience" in the Methods column gives details of prior experience of the operations the surgeons performed in the trial. "Yes" = 1 in the quality assessment tool (Item 5); "No" = 0, which could also reflect a lack of information.
IM: intramedullary
IMHS: intramedullary hip screw
PFN: proximal femoral nail
PFNA: proximal femoral nail antirotation
SHS: sliding hip screw
PCCP: percutaneous compression plate

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Azzoni 2004	This was a retrospective comparison of 208 people with a trochanteric fracture treated with either an intramedullary nail or a sliding hip screw. The study was excluded because there was no randomisation of patients.
Bhatti 2003	This was a prospective comparison of 70 people treated with either the proximal femoral nail or dynamic hip screw, with the choice of treatment being the preference of the surgeon. It was excluded because it was not a randomised study.
Bienkowski 2006	This was a prospective comparison of 60 people with a trochanteric fracture treated with either a trochanteric femoral nail or a sliding hip screw. The study was excluded because the choice of treatment was according to the preference and experience of the attending surgeon, with no randomisation of patients.
Cao 2009	This was reported as a randomised trial of 95 patients with a trochanteric fractures treated with either a Gamma nail, proximal femoral nail or a dynamic hip screw. The English abstract implied that the population was randomly divided according to the Evans classification system. Overall, there was limited reporting of the study methodology within the paper such that it was not possible to determine clearly if it was a randomised controlled trial or an observational study. The study was excluded because it was uncertain that it was a randomised controlled trial.
Davison 1996	An interim report of this randomised trial comparing the intramedullary hip screw with the sliding hip screw was reported in a conference abstract published 1996. In 1995, 134 people had been entered in the study. Of the 63 available for clinic review at 6 months, there had been 6 cut-outs in each group. There were no other implant failures or femoral fractures reported. Pain and mobility were similar in both groups. The trial was stated to be continuing but no further results have been presented or made available and correspondence with the author indicated that further information was not available. The study was excluded because it reported only very limited and interim outcomes.
DiCicco 2000	In this study, people with femoral shaft fractures were allocated antegrade or retrograde nailing of femur fracture according to their medical record numbers. All subtrochanteric fractures, which were not included in the quasi-randomised trial, were treated with retrograde nailing. The study was excluded because there was no randomisation of proximal femoral fractures.
Fritz 1999	Randomised comparison with 80 people allocated to either the Gamma nail or a gliding nail, which is the same as a gamma nail except the lag screw is changed to a nail. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.

(*Continued*)

Hardy 2003	This randomised trial of 80 people with a trochanteric fracture compared the use of a standard intramedullary hip screw against an intramedullary hip screw with a slotted distal locking hole. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Herrera 2002	This was a randomised comparison of 125 people treated with the Gamma nail versus 125 people treated with the proximal femoral nail. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Hogh 1992	This randomised trial from Denmark of 299 cases compared the Gamma nail with the sliding hip screw. The study was reported in conference abstracts only. The results as detailed showed "no difference" in mean operative times, operative blood loss, wound drainage or post-operative haemoglobin levels. Mortality was similar in both groups. Cut-out occurred in six cases in the sliding hip screw group and 10 in the Gamma nail group. There were eight cases in the Gamma nail group of operative or later fracture around the nail. Reoperations were required in six cases in the sliding hip screw group and 12 in the Gamma group. The study was excluded because the exact numbers of cases allocated to each group was not given. Correspondence with medical staff at the trial hospital indicated that no further information was now available.
Hu 2006	This was a study of 88 patients with a trochanteric fractures treated with either a proximal femoral nail, a dynamic condylar screw plate, a proximal femoral plate or a dynamic hip screw. The study was excluded because there was no randomisation of patients.
Kafer 2005	Study, reported in German, comparing the results of 53 people treated with a proximal femoral nail versus 59 people treated with a dynamic hip screw. This study was excluded because there was no randomisation of patients.
Khan 2002	The contact trialist listed in the National Research Register (UK) entry for this study, reported to compare the trochanteric intramedullary nail versus the dynamic compression screw, confirmed that the trial did not "get off the ground".
Klinger 2005	This was a comparative study of 122 people with unstable trochanteric fractures treated with the proximal femoral nail and 51 treated with the dynamic hip screw with a trochanteric buttress-press plate. It was excluded because it was not a randomised study.
Liu 2008	This was reported as a randomised trial of 130 patients with trochanteric fractures treated with either a Gamma nail or a dynamic hip screw. There was limited reporting of the study methodology within the paper such that it was not possible to determine clearly if it was a randomised controlled trial or an observational study. The study was excluded because it was uncertain that it was a randomised controlled trial.
Merenyi 1995	This conference abstract suggested a randomised trial comparing 40 Ender nails with 40 angle plates, and 40 Gamma nails (3 types). Correspondence with the authors indicated that there was no randomisation of patients only a random selection of people who had been previously treated with one of the different implants.
Moran 2000	This was a randomised trial of unstable intertrochanteric fractures comparing the proximal femoral nail and the dynamic hip screw. The trial co-ordinator was Mr CG Morgan, Department of Trauma & Orthopaedics, C Floor, West Block, University Hospital, Nottingham, NG7 2UH, UK. Recruitment to the study was suspended in 1999 due to problems with the proximal femoral nail and no outcome data for the limited number of trial participants has been made available.

(*Continued)*

Nouisri 2006	This was a comparison of 100 patients with a trochanteric fracture treated with either a Gamma nail or dynamic hip screw. It was excluded because it was not a randomised study.
Nuber 2003	Study, reported in German, comparing the results of 65 people treated with a proximal femur nail versus 64 people treated with a dynamic hip screw with trochanteric stabilisation plate. This study was excluded when it was confirmed to be a retrospective comparison of two cohorts by Annette Blumle of the German Cochrane Centre.
Pan 2009	This was reported as a randomised trial of 131 patients with a trochanteric fractures treated with either a proximal femoral nail or a dynamic hip screw. There was limited reporting of the study methodology within the paper such that it was not possible to determine clearly if it was a randomised controlled trial or an observational study. The study was excluded because it was uncertain that it was a randomised controlled trial.
Prinz 1996	Only preliminary results were provided in the conference abstract report of this randomised trial. There were 38 people treated with a sliding hip screw, 43 with a Gamma nail and 41 with an intramedullary hip screw recruited between 01/03/1995 and 01/03/1996. The study was excluded because of the inadequate reporting of the trial outcomes; preliminary results only being available. Should a full report of this ever become available, it is likely that we will reconsider this decision.
Roder 1995	This was a randomised trial of 75 people with stable trochanteric fracture: 25 were treated with a sliding hip screw 25 with a Gamma nail and 25 with a Gamma nail with a modification of the surgical technique using a 4.5 mm drill hole in the lateral femur approximately 5 cm distal to the tip of the nail. The aim was to determine if the drill hole would reduce the risk of bone marrow vascular embolism. The only outcome measure was the degree of marrow embolisation as determined by transoesophageal ultrasound. The results indicated minimal bone marrow embolisation with the SHS and mild embolisation with the Gamma nail inserted with a distal femoral drill hole. For the 25 people treated with the Gamma nail inserted without a drill hole there was heavy bone marrow embolisation as judged by ultrasound. The trial was excluded as: 1. There were no clinical outcomes relevant to this review of SHS versus Gamma nail 2. There was no follow up of trial participants The study is included in the Cochrane review ' Osteotomy, compression and reaming techniques for internal fixation of extracapsular hip fractures'
Saarenpaa 2009	This was a comparative matched pair study of 268 people with trochanteric fractures treated with the Gamma nail or the dynamic hip screw. It was excluded because it was not a randomised study.
Schipper 2004	This was a randomised trial comparing the Gamma nail with the proximal femoral nail in 424 people. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Tarantino 2005	This was a two-centre comparison between the Gamma nail versus a variable angle sliding hip screw in 142 people with extracapsular hip fractures. Patients who had undergone fixation with the Gamma nail at one hospital were matched by age, sex and type of fracture to patients treated with a sliding screw device at the other hospital. The study was excluded because there was no randomisation of patients.
Zhang 2009	This study compared proximal femoral antirotation nail, bipolar hemiarthroplasty or a dynamic hip screw in 73 patients with a trochanteric fractures. The study was excluded because there was no randomisation of patients.

(*Continued*)

Zhao 2009	This was a study comparing 104 patients with a trochanteric fractures treated with either a proximal femoral nail (33 patients) or a dynamic hip screw (71 patients). There was no indication in the English abstract of this report that this was a randomised controlled trial or even a prospective study.
Ziran 2009	This was a comparative study of 94 patients with trochanteric fractures treated with either a Gamma nail or a compression hip screw. Choice of fixation was at the preference of the attending surgeon. The study was excluded because it was not a randomised trial.

Characteristics of studies awaiting assessment *[ordered by study ID]*

Ahmad

Methods	Randomised controlled trial: "Computer generated random tables will be used. Delivery of randomisation will be in opaque sealed envelopes to be opened at the time of operation in the operating theatre."
Participants	Extracapsular femoral fractures
Interventions	intramedullary hip screw versus compression hip screw
Outcomes	Haemodynamic changes during surgical procedure Oxygen saturation & blood pressure Mini-mental scores (post-operative) Length of hospital stay Pulmonary embolus Mortality
Notes	Main purpose of trial was to record haemodynamic changes. There was intraoperative monitoring of the cardiovascular system Abstract and NRR (UK) registration only Number of participants not reported in the conference abstract

Rafiq 2009

Methods	Randomised controlled trial using "computer generated random numbers". Single centre.
Participants	64 patients with subtrochanteric fractures
Interventions	Interlocking intramedullary nail versus dynamic condylar screw
Outcomes	Follow-up: 1 year Length of surgery Intra-operative blood loss Non-union Time to fracture union Cut-out Infection

Rafiq 2009 (*Continued)*

	Time for full weightbearing Functional recovery (Sikorski and Barrington pain and mobility scale) Range of hip motion Muscle strength Radiographic outcomes
Notes	Abstract only

White

Methods	Randomised controlled trial. Single centre.
Participants	Unstable hip fractures
Interventions	DHS versus the PFN
Outcomes	Not stated
Notes	NRR (UK) registration only - minimum information available

Characteristics of ongoing studies *[ordered by study ID]*

Matre

Trial name or title	A prospective randomised multicentre study comparing the sliding hip screw and the Intertan nail in trochanteric and subtrochanteric femoral fractures
Methods	Randomised controlled trial
Participants	Intended: 500 participants Inclusion Criteria: • Patients older than 60 years with a trochanteric or subtrochanteric hip fracture. Exclusion Criteria: • Patients with pathologic fractures, patients already included with a fracture on the opposite side.
Interventions	Intertan intramedullary nail versus the Sliding hip screw
Outcomes	Length of follow-up: 1 year Early postoperative pain (VAS) and functional mobility (TUG-test) Pain, functional mobility (TUG-test), Harris Hip Score, quality of life (EQ-5D) and complications at discharge from hospital, and at 6 weeks, 3 and 12 months postop.
Starting date	February 2008
Contact information	Kjell Matre, MD, Head of Orthopaedic Trauma, Department of Orthopaedics, Haukeland University Hospital, Norway kjell.matre@helse-bergen.no

Matre (*Continued*)

Notes	

Molnar

Trial name or title	Prospective randomised pilot study comparing the dynamic hip screw and intramedullary Gamma nail regarding the treatment of intertrochanteric hip fracture
Methods	Randomised controlled trial, with blinding of participants and outcome assessors
Participants	60 patients, aged between 18 and 100 years, with non-pathological intertrochanteric hip fractures resulting from low-energy injury. Excluded: previous ipsilateral hip or femur surgery, associated neurovascular injury, unable to understand / comply with follow-up procedures, medical contraindication to surgery or anaesthesia.
Interventions	Gamma 3 trochanteric nail versus or the Sliding hip screw
Outcomes	Length of follow-up: 2 years Operative data: Surgical time, fluoroscopy time, blood loss/ blood transfusion, skin incision length Post-operative data: Functional recovery score, fracture collapse, 6 minute walk test
Starting date	01/08/2008
Contact information	Rob Molnar, 4 Short St, Kogarah, New South Wales 2217, Australia
Notes	

Parker

Trial name or title	Randomised trial of Targon intramedullary nail versus sliding hip screw for trochanteric fractures
Methods	Randomised controlled trial, blinded assessors
Participants	600 patients with a trochanteric hip fracture which is to be treated surgically
Interventions	Targon intramedullary nail versus sliding hip screw
Outcomes	Length of follow-up: 1 year. Full record of operative and follow-up outcomes
Starting date	2001
Contact information	Dr Martyn J Parker, MD, FRCS Orthopaedic Research Fellow Department of Trauma & Orthopaedics Peterboroughand Stamford Hospitals NHS Foundation Trust Thorpe Road Peterborough PE3 6DA

Parker *(Continued)*

	UK Tel: +44 1733 874000 (bleep 1133) E-mail: martyn.parker@pbh-tr.nhs.uk
Notes	Due to be completed December 2010

REGAIN

Trial name or title	Re-Evaluation of GA mma3 Intramedullary Nails in hip fracture: A multi-centre randomised controlled trial of Gamma3 intramedullary nails versus sliding hip screws in the management of intertrochanteric fractures of the hip
Methods	Randomised, double blind (participant, outcomes assessor)
Participants	Intended: 90 participants Inclusion criteria: • Adult men or women aged 50 years and older (with no upper age limit). • An intertrochanteric fracture (stable or unstable) confirmed with anterior and posterior lateral hip radiographs, computed tomography, or magnetic resonance imaging (MRI). • Operative treatment within 3 days (i.e., 72 hours) after the trauma. • Patient was ambulatory prior to fracture, though they may have used an aid such as a cane or a walker. • Anticipated medical optimalisation of the patient for operative fixation of the hip. • Provision of informed consent by patient or proxy. • Low energy fracture (defined as a fall from standing height). • No other major trauma. Exclusion Criteria: • Associated major injuries of the lower extremity (i.e., ipsilateral or contralateral fractures of the foot, ankle, tibia, fibula, knee, or femur; dislocations of the ankle, knee, or hip; or femoral head defects or fracture). • Retained hardware around the affected hip. • Infection around the hip (i.e., soft tissue or bone). • Patients with disorders of bone metabolism other than osteoporosis (i.e., Paget's disease,renal osteodystrophy, or osteomalacia). • Moderate or severe cognitively impaired patients (i.e., Six Item Screener with three or more errors). • Patients with Parkinson's disease (or dementia) severe enough to increase the likelihood of falling or severe enough to compromise rehabilitation. • Likely problems, in the judgment of the investigators, with maintaining follow-up. The investigators will, for example, exclude patients with no fixed address, those who report a plan to move out of town in the next year, or intellectually challenged patients without adequate family support. • If the attending surgeon believes that a patient should be excluded from REGAIN because the patient is enrolled in another ongoing drug or surgical intervention trial. • If the attending surgeon believes that there is another reason to exclude this patient from REGAIN. This reason will be documented on the case report forms.
Interventions	Gamma3 intramedullary nail (Stryker) versus the sliding hip screw
Outcomes	Length of follow-up: 2 years • Rates of revision surgery

	• HRQL (SF-12,WOMAC,EQ-5D, Merle d'Aubigne (MDA), Parker Mobility score) [Time frame: hospital admission, 1 and 2 weeks, 3, 6, 9,12, 18 and 24 months] • Fracture healing rates [Time frame: 3, 6, 9,12, 18 and 24 months] • Complications (mortality, femoral shaft fracture, avascular necrosis, nonunion, malunion, implant breakage/failure, infection) [Time frame: hospital admission, 1 and 2 weeks, 3, 6, 9,12, 18 and 24 months]
Starting date	May 2007
Contact information	Helena Viveiros, BSc. BA 905-527-4322 ext 44696 viveiro@mcmaster.ca Sheila Sprague, MSc. 905-527-4322 ext 44490 spags@mcmaster.ca
Notes	

Schipper

Trial name or title	Fixation device related rotational and translational influences in trochanteric femoral fractures: A radio stereometric analysis of the DHS versus the gamma-nail
Methods	Randomised
Participants	60 patients, aged over 60 years , with non-pathological intertrochanteric hip fractures. Excluded: severe arthritis of the involved hip, rheumatoid arthritis, previously immobile
Interventions	Gamma nail versus the sliding hip screw
Outcomes	Length of follow-up: 1 year Radiostereometric analysis (RSA) will be used to measure micromotion along the three orthogonal axes of the fracture fragments. RSA radiographs are obtained postoperatively, on the first day, after 6 weeks, 4 months and one year Local adverse events (cut-out, implant failure)
Starting date	Not stated, trial registration: 16/02/2010
Contact information	Dr I B Schipper, Leiden University Medical Center, Leiden, The Netherlands
Notes	

DATA AND ANALYSES

Comparison 1. Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	12	1899	Mean Difference (IV, Random, 95% CI)	1.15 [-9.85, 12.16]
1.1 Gamma nail	6	1045	Mean Difference (IV, Random, 95% CI)	2.48 [-3.60, 8.56]
1.2 Intramedullary hip screw (IMHS)	3	337	Mean Difference (IV, Random, 95% CI)	8.81 [-7.43, 25.05]
1.3 Proximal femoral nail (PFN)	1	206	Mean Difference (IV, Random, 95% CI)	-1.0 [-9.14, 7.14]
1.5 Holland nail	1	190	Mean Difference (IV, Random, 95% CI)	13.70 [8.15, 19.25]
1.6 Proximal femoral nail antirotation	1	121	Mean Difference (IV, Random, 95% CI)	-41.0 [-45.11, -36.89]
2 Operative fracture of the femur	26	3931	Risk Ratio (M-H, Fixed, 95% CI)	3.16 [1.73, 5.79]
2.1 Gamma nail (minus Papasimos 2005, see sub-category 8)	17	2650	Risk Ratio (M-H, Fixed, 95% CI)	3.02 [1.48, 6.14]
2.2 Intramedullary hip screw (IMHS)	5	627	Risk Ratio (M-H, Fixed, 95% CI)	5.01 [1.11, 22.65]
2.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)	1	206	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.8 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	1.52 [0.06, 36.46]
2.9 Two nail types (Gamma or Endovis BA nail)	1	118	Risk Ratio (M-H, Fixed, 95% CI)	2.0 [0.19, 21.46]
3 Later fracture of the femur	29	3849	Risk Ratio (M-H, Fixed, 95% CI)	5.22 [2.56, 10.64]
3.1 Gamma nail (minus Papasimos 2005, see sub-category 8)	19	2593	Risk Ratio (M-H, Fixed, 95% CI)	5.23 [2.46, 11.14]
3.2 Intramedullary hip screw (IMHS)	4	447	Risk Ratio (M-H, Fixed, 95% CI)	5.12 [0.61, 43.33]
3.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)	1	108	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.5 Holland nail	1	190	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.6 Proximal femoral nail antirotation	1	121	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.8 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Cut-out (overall denominators used)	30	4324	Risk Ratio (M-H, Fixed, 95% CI)	1.13 [0.79, 1.60]

4.1 Gamma nail (minus Papasimos 2005, see sub-category 8)	19	2792	Risk Ratio (M-H, Fixed, 95% CI)	1.18 [0.77, 1.79]
4.2 Intramedullary hip screw (IMHS)	4	517	Risk Ratio (M-H, Fixed, 95% CI)	0.83 [0.24, 2.84]
4.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	2.07 [0.39, 11.10]
4.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.21, 6.37]
4.5 Holland nail	1	190	Risk Ratio (M-H, Fixed, 95% CI)	0.21 [0.01, 4.38]
4.6 Proximal femoral nail antirotation	1	121	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	1.65 [0.28, 9.67]
4.8 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.13, 4.31]
5 Non-union (overall denominators used)	16	2112	Risk Ratio (M-H, Fixed, 95% CI)	0.84 [0.34, 2.10]
5.1 Gamma nail (minus Papasimos 2005, see sub-category 8)	8	1088	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.25, 3.93]
5.2 Intramedullary hip screw (IMHS)	3	307	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.21, 4.95]
5.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)	1	206	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.6 Proximal femoral nail antirotation	1	121	Risk Ratio (M-H, Fixed, 95% CI)	0.36 [0.02, 8.70]
5.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.8 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.03, 7.79]
6 Reoperation (overall denominators used)	26	3909	Risk Ratio (M-H, Fixed, 95% CI)	1.49 [1.12, 1.98]
6.1 Gamma nail (minus Papasimos 2005, see sub-category 8)	17	2684	Risk Ratio (M-H, Fixed, 95% CI)	1.71 [1.22, 2.40]
6.2 Intramedullary hip screw (IMHS)	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.53 [0.15, 1.88]
6.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	2.07 [0.64, 6.73]
6.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.21, 6.37]
6.5 Holland nail	1	190	Risk Ratio (M-H, Fixed, 95% CI)	0.35 [0.01, 8.60]
6.6 Proximal femoral nail antirotation	1	121	Risk Ratio (M-H, Fixed, 95% CI)	0.15 [0.01, 2.94]
6.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	1.65 [0.28, 9.67]
6.8 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	1.33 [0.37, 4.75]
7 Deep wound infection	21	3116	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.54, 2.17]
7.1 Gamma nail	12	1869	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.46, 2.17]

7.2 Intramedullary hip screw (IMHS)	3	390	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.08]
7.3 Proximal femoral nail (PFN)	2	276	Risk Ratio (M-H, Fixed, 95% CI)	3.38 [0.36, 31.84]
7.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7.5 Holland nail	1	190	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7.6 Proximal femoral nail antirotation	1	121	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8 Mortality	26	3641	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.88, 1.15]
8.1 Gamma nail	16	2306	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.81, 1.12]
8.2 Intramedullary hip screw (IMHS)	4	443	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.67, 1.24]
8.3 Proximal femoral nail (PFN)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	1.40 [0.75, 2.62]
8.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.53 [0.15, 15.97]
8.5 Holland nail	1	190	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.54, 1.86]
8.7 Long Gamma nail	1	210	Risk Ratio (M-H, Fixed, 95% CI)	1.47 [0.93, 2.31]
8.8 Two nail types (Gamma or Endovis BA nail)	1	118	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.61]
9 Pain at follow-up	8	897	Risk Ratio (M-H, Fixed, 95% CI)	1.10 [0.93, 1.30]
9.1 Gamma nail	5	634	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.90, 1.30]
9.2 Intramedullary hip screw (IMHS)	3	263	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.79, 1.75]
10 Non return to previous residence or dead	9	1070	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.88, 1.16]
10.1 Gamma nail	4	439	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.70, 1.15]
10.2 Intramedullary hip screw (IMHS)	3	330	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.82, 1.33]
10.3 Proximal femoral nail (PFN)	2	301	Risk Ratio (M-H, Fixed, 95% CI)	1.11 [0.89, 1.39]

Comparison 2. Gamma nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	6	1045	Mean Difference (IV, Random, 95% CI)	2.48 [-3.60, 8.56]
2 Blood loss (ml)	5	953	Mean Difference (IV, Random, 95% CI)	-29.04 [-73.17, 15.10]
3 Number of people given transfusion	3	756	Risk Ratio (M-H, Random, 95% CI)	1.06 [0.67, 1.68]
4 Radiographic screening time (seconds)	4		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5 Operative fracture of femur	18	2730	Risk Ratio (M-H, Fixed, 95% CI)	3.02 [1.51, 6.03]
5.1 Gamma 1 nail	15	2294	Risk Ratio (M-H, Fixed, 95% CI)	3.26 [1.49, 7.16]
5.2 Trochanteric Gamma nail	3	436	Risk Ratio (M-H, Fixed, 95% CI)	2.23 [0.51, 9.78]

6 Operative fracture of femur (reported experience with devices)	18	2730	Risk Ratio (M-H, Fixed, 95% CI)	3.02 [1.51, 6.03]
6.1 Experienced surgeon (low risk of bias)	6	1239	Risk Ratio (M-H, Fixed, 95% CI)	2.47 [0.92, 6.60]
6.2 Not experienced surgeon (high/unclear risk of bias)	10	1202	Risk Ratio (M-H, Fixed, 95% CI)	5.05 [1.47, 17.29]
6.3 Mixed experience (high risk of bias)	2	289	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.26, 8.77]
7 Later fracture of femur	20	2673	Risk Ratio (M-H, Fixed, 95% CI)	5.23 [2.46, 11.14]
8 Cut-out	20	2695	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.76, 1.72]
9 Cut-out (reported experience with devices)	20	2695	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.76, 1.72]
9.1 Experienced surgeon (low risk of bias)	6	1127	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.52, 2.08]
9.2 Not experienced surgeon (high/unclear risk of bias)	12	1279	Risk Ratio (M-H, Fixed, 95% CI)	1.37 [0.80, 2.36]
9.3 Mixed experience (high risk of bias)	2	289	Risk Ratio (M-H, Fixed, 95% CI)	0.51 [0.11, 2.28]
10 Non-union	9	1050	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.29, 3.31]
11 Reoperation	18	2665	Risk Ratio (M-H, Fixed, 95% CI)	1.66 [1.19, 2.31]
11.1 Gamma 1 nail	15	2276	Risk Ratio (M-H, Fixed, 95% CI)	1.80 [1.24, 2.62]
11.2 Trochanteric Gamma nail	3	389	Risk Ratio (M-H, Fixed, 95% CI)	1.23 [0.61, 2.47]
12 Wound infection or haematoma	17		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
12.1 Wound infection - any type	14	1794	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.62, 1.50]
12.2 Deep wound infection	12	1869	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.46, 2.17]
12.3 Wound haematoma	8	819	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.34, 1.79]
13 Pneumonia	9	921	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.47, 1.83]
14 Pressure sore	5	466	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.32, 1.42]
15 Thromboembolic complications	12		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
15.1 Thromboembolic complication	11	1627	Risk Ratio (M-H, Fixed, 95% CI)	1.46 [0.90, 2.36]
15.2 Deep vein thrombosis	10	1506	Risk Ratio (M-H, Fixed, 95% CI)	1.26 [0.77, 2.06]
15.3 Pulmonary embolism	4	401	Risk Ratio (M-H, Fixed, 95% CI)	1.97 [0.50, 7.82]
16 Any medical complication (other than wound infection or haematoma)	6	629	Risk Ratio (M-H, Random, 95% CI)	1.13 [0.69, 1.84]
17 Length of hospital stay (days)	5	620	Mean Difference (IV, Fixed, 95% CI)	-0.13 [-1.50, 1.24]
18 Anatomical deformity	8		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
18.1 Shortening of leg	3	335	Risk Ratio (M-H, Fixed, 95% CI)	0.46 [0.21, 1.03]
18.2 Varus deformity	5	679	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.34, 1.37]
18.3 External rotational deformity	2	229	Risk Ratio (M-H, Fixed, 95% CI)	1.09 [0.28, 4.19]
19 Mortality	16	2306	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.81, 1.12]
20 Mortality (grouped by allocation concealment)	16	2306	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.81, 1.12]
20.1 Allocation concealment: fully concealed	4	714	Risk Ratio (M-H, Fixed, 95% CI)	1.07 [0.81, 1.41]

20.2 Allocation concealment: unclear	6	943	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.68, 1.14]
20.3 Allocation concealment: not concealed	6	649	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.66, 1.31]
21 Pain at follow-up	5	634	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.90, 1.30]
22 Non-return to previous residence	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
22.1 Non-return to previous residence (survivors)	3	189	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.39, 1.31]
22.2 Non-return to previous residence or dead	4	439	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.70, 1.15]
23 Impaired walking	8		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
23.1 Impaired walking	8	984	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.89, 1.10]
23.2 Impaired walking (overall denominators used)	8	1311	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.89, 1.13]

Comparison 3. Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	3	337	Mean Difference (IV, Random, 95% CI)	8.81 [-7.43, 25.05]
2 Blood loss (ml)	2	235	Mean Difference (IV, Fixed, 95% CI)	-62.42 [-98.56, -26.28]
3 Transfusion (units of red cells)	2	235	Mean Difference (IV, Random, 95% CI)	-0.00 [-0.68, 0.67]
4 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5 Radiographic screening time (minutes)	2	237	Mean Difference (IV, Fixed, 95% CI)	1.15 [0.83, 1.47]
6 Fracture fixation complications	5		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Operative fracture of femur	5	627	Risk Ratio (M-H, Fixed, 95% CI)	5.01 [1.11, 22.65]
6.2 Later fracture of femur	4	447	Risk Ratio (M-H, Fixed, 95% CI)	5.12 [0.61, 43.33]
6.3 Cut-out	4	517	Risk Ratio (M-H, Fixed, 95% CI)	0.83 [0.24, 2.84]
6.4 Non-union	3	307	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.21, 4.95]
6.5 Detachment of the plate from the femur	1	102	Risk Ratio (M-H, Fixed, 95% CI)	0.35 [0.01, 8.31]
6.6 Reoperation	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.53 [0.15, 1.88]
7 Wound infection or haematoma	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Wound infection - any type	3	390	Risk Ratio (M-H, Fixed, 95% CI)	0.4 [0.08, 2.01]
7.2 Deep wound infection	3	390	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.08]
7.3 Wound haematoma	3	345	Risk Ratio (M-H, Fixed, 95% CI)	1.47 [0.54, 4.02]
8 Post-operative complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
8.1 Pneumonia	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.35, 2.83]
8.2 Thromboembolic complication	1	100	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.05, 5.34]
8.3 Deep vein thrombosis	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.17, 5.62]
8.4 Pulmonary embolism	1	100	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.99]

8.5 Major medical complication	2	245	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.64, 2.10]
9 Length of hospital stay (days)	2	237	Mean Difference (IV, Fixed, 95% CI)	1.00 [-1.37, 3.37]
10 Mean limb shortening (cm)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11 Final outcome measures	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
11.1 Mortality	4	443	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.67, 1.24]
11.2 Pain	3	263	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.79, 1.75]
11.3 Failure to return home (survivors)	3	256	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.78, 1.73]
11.4 Failure to return home or dead	3	330	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.82, 1.33]
11.5 Failure to return home or dead (overall denominators used)	3	341	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.79, 1.28]
11.6 Failure to regain mobility	1	105	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.53, 1.73]
11.7 Poor mobility	1	88	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.48, 1.35]

Comparison 4. Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Blood loss and transfusion	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Blood loss (ml)	1	108	Mean Difference (IV, Fixed, 95% CI)	-37.0 [-192.78, 118.78]
2.2 Transfusion (units of red blood cells)	2	314	Mean Difference (IV, Fixed, 95% CI)	-0.20 [-0.62, 0.22]
3 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5 Fracture fixation complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Operative fracture femur	1	80	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Later fracture of femur	2	188	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.3 Cut-out	3	356	Risk Ratio (M-H, Fixed, 95% CI)	1.31 [0.36, 4.75]
5.4 Cut-out: overall denominators used	3	394	Risk Ratio (M-H, Fixed, 95% CI)	1.28 [0.35, 4.67]
5.5 Non-union	2	248	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.95]
5.6 Reoperation	3	356	Risk Ratio (M-H, Fixed, 95% CI)	1.94 [0.80, 4.71]
5.7 Reoperation: overall denominators used	3	394	Risk Ratio (M-H, Fixed, 95% CI)	1.90 [0.78, 4.62]
6 Wound infection or haematoma	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Superficial wound infection	2	188	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.44]
6.2 Deep wound infection	2	276	Risk Ratio (M-H, Fixed, 95% CI)	3.38 [0.36, 31.84]
6.3 Haematoma	1	80	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.21, 4.66]
7 Post-operative complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Pneumonia	2	286	Risk Ratio (M-H, Fixed, 95% CI)	1.06 [0.39, 2.91]
7.2 Pressure sores	1	206	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.18, 3.46]

7.3 Deep vein thrombosis	3	394	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.12, 3.98]
7.4 Pulmonary embolism	2	286	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.12, 3.98]
7.5 Urinary tract infection	2	286	Risk Ratio (M-H, Fixed, 95% CI)	1.48 [0.95, 2.30]
7.6 Any medical complication	1	206	Risk Ratio (M-H, Fixed, 95% CI)	1.12 [0.85, 1.49]
8 Length of hospital stay (days)	2	314	Mean Difference (IV, Fixed, 95% CI)	0.27 [-0.76, 1.30]
9 Final outcome measures	3		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Mortality in hospital	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Mortality at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.3 Mortality at 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.4 In nursing home at 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.5 In nursing home or dead at 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.6 In nursing home or dead at 1 year (overall denominators used)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.7 Failure to regain pre-fracture residential status at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.8 Failure to regain pre-fracture residential status, seriously ill or dead at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.9 Failure to recover previous mobility at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.10 Failure to recover previous mobility or dead at 4 months (overall denominators used)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 5. Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.1 Cut-out of the implant	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.2 Later fracture of the femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.3 Fracture non-union	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.4 Breakage of implant and/or detachment of the plate from the femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.5 Reoperation for fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Superficial wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

5.2 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Post-operative complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6.1 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7 Poor or fair hip function score (1 year)	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 6. Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Later fracture of the femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.2 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 Non-union	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.4 Reoperation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 All wound infections	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Post-operative compiications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.2 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Mortality (3 months)	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 7. Holland nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of anaesthesia and surgery	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Length of anaesthesia (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
1.2 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3 Blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4 Number of patients given transfusion	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5 Days till mobilisation	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6.1 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6.2 Later fracture of femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6.3 Reoperation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

7.1 Superficial wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7.2 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8 Postoperative complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
8.1 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8.2 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8.3 Pulmonary embolism	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Final outcome measures	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Mortality at 30 days	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Mortality at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.3 Failure to regain mobility at one year (survivors)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Final outcome measures: mobility score (0 to 9: best result)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

Comparison 8. Long Gamma nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Operative fracture of femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Later fracture of the femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.3 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.4 Non-union	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.5 Reoperation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Mortality (at one year)	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 9. Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Blood loss	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2.2 Total blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Radiographic screening time (seconds)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
4 Time to radiographic healing (weeks)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5 Mortality (6 months)	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

6 Time to effective weight bearing (weeks)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only

Comparison 10. Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.2 Implant breakage, bending or uncoupling	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 Reoperation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Superficial wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Post-operative complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Thromboembolic complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.2 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.3 Pressure sores	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.4 Urinary infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Anatomical deformity	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.1 Leg shortening > 2.5 cm	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.2 Varus deformity > 15 degrees	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.3 External rotation deformity > 15 degrees	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Final outcome measures (1 year)	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Failure to regain pre-fracture mobility	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.3 Death or failure to regain pre-fracture mobility	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 11. Two nail types versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Operative outcomes	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Radiographic exposure (Gy/m²)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Operative fracture of the femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3 Superficial wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4 Post-operative complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

4.1 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.2 Delirium	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.3 Cardiovascular complication	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.4 Respiratory complication	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Mortality (in hospital)	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6 Days to independent walking	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

Comparison 12. Femoral nail (2 types) versus Medoff sliding plate

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Proximal femoral nail (PFN)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Proximal femoral nail (PFN)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Proximal femoral nail (PFN)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 Operative fracture of the femur	2	420	Risk Ratio (M-H, Fixed, 95% CI)	4.84 [0.57, 40.81]
4.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	6.94 [0.36, 132.70]
4.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	2.80 [0.12, 67.98]
5 Later fracture of femur	2	420	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Cut-out	2	420	Risk Ratio (M-H, Fixed, 95% CI)	1.44 [0.52, 4.01]
6.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.74 [0.17, 3.24]
6.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	2.8 [0.58, 13.55]
7 Non-union	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
7.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8 Reoperation	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
8.1 Gamma nail	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8.2 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Wound infection - any type	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Gamma nail	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
10.1 Gamma nail	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
11 Wound haematoma	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

11.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
12 Severe medical complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
12.1 Gamma nail	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
13 Mortality at 1 year	2	420	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.53, 1.12]
13.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.48, 1.22]
13.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.42, 1.46]
14 Inability to walk 15 metres at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
14.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
15 Inability to rise from a chair at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
15.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
16 Inability to climb a curb at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
16.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
17 Need to use walking aids at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
17.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 13. Gamma nail versus percutaneous compression plate (PCCP)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Post-operative complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.2 Confusion	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.3 Stroke	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.4 Congestive cardiac failure	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.5 Genitourinary infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Discharged to intermediate care	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Hospital mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Mortality (one year)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Failure to regain mobility at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6.1 In survivors	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6.2 Dead or failed to recover former mobility	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 14. Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 Non-union	2	61	Risk Ratio (M-H, Fixed, 95% CI)	0.42 [0.06, 2.69]
4.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1	35	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.06, 13.93]
4.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.01, 3.80]
5 Operative fracture of femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Cut-out	2	65	Risk Ratio (M-H, Fixed, 95% CI)	0.32 [0.07, 1.53]
6.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	0.09 [0.01, 1.47]
6.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	3.0 [0.13, 67.51]
7 Plate breakage	2	65	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.04, 2.97]
7.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	0.32 [0.01, 7.35]
7.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.50]
8 Reoperation (major)	2	65	Risk Ratio (M-H, Fixed, 95% CI)	0.07 [0.00, 1.22]
8.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	0.07 [0.00, 1.22]
8.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Deep wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

10 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
10.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
11 Pressure sores	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
11.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
12 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
12.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
13 Pulmonary embolism	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
13.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
13.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
14 All medical complications	2	65	Risk Ratio (M-H, Fixed, 95% CI)	1.20 [0.69, 2.06]
14.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	1.22 [0.57, 2.62]
14.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.54, 2.53]
15 Length of hospital stay (days)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
15.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
16 Mortality (1 year)	2	65	Risk Ratio (M-H, Fixed, 95% CI)	1.9 [0.19, 19.27]
16.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	1.9 [0.19, 19.27]
16.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
17 Pain at follow-up	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
17.1 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
18 In nursing home at one year from injury	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
18.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
19 In nursing home or dead at one year from injury	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
19.1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
20 Use of walking aids	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
20.1 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 15. Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Russell-Taylor nail versus Dynamic condylar screw	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Radiographic screening time (seconds)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Russell-Taylor nail versus Dynamic condylar screw	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Russell-Taylor nail versus Dynamic condylar screw	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 Number of patients given transfusion	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.1 Russell-Taylor nail versus Dynamic condylar screw	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Non-union	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Proximal femoral nail (PFN) versus 95 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Russell-Taylor nail versus Dynamic condylar screw	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Reoperation	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
6.1 Proximal femoral nail (PFN) versus 95 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6.2 Russell-Taylor nail versus Dynamic condylar screw	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7 Any wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
7.1 Proximal femoral nail (PFN) versus 95 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
7.2 Russell-Taylor nail versus Dynamic Condylar Screw	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8 Length of hospital stay (days)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
8.1 Russell-Taylor nail versus Dynamic condylar screw	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
9 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Proximal femoral nail (PFN) versus 95 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Pain score (1: no pain to 4: worst pain)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
10.1 Russell-Taylor nail versus Dynamic condylar screw. Hip pain	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable

10.2 Russell-Taylor nail versus Dynamic condylar screw. Thigh pain	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable
11 Mobility score (0: complete disability, 9: no difficulty)	1	Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11.1 Russell-Taylor nail versus Dynamic condylar screw	1	Mean Difference (IV, Fixed, 95% CI)	Not estimable

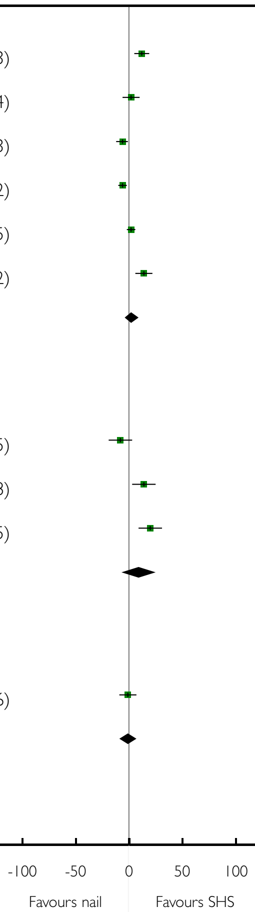
Analysis 1.1. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Femoral nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
1 Gamma nail							
O'Brien 1995	53	59 (23.9)	49	47 (13.3)		8.4 %	12.00 [4.57, 19.43]
Hoffman 1996	31	56.7 (17)	36	54.3 (16.4)		8.3 %	2.40 [-5.63, 10.43]
Kukla 1997	60	47.1 (20.8)	60	53.4 (8.3)		8.5 %	-6.30 [-11.97, -0.63]
Adams 2001	203	55.4 (20)	197	61.3 (22.2)		8.6 %	-5.90 [-10.04, -1.76]
Utrilla 2005	104	46 (11)	106	44 (15)		8.6 %	2.00 [-1.55, 5.55]
Ovesen 2006	73	65 (29)	73	51 (22)		8.3 %	14.00 [5.65, 22.35]
Subtotal (95% CI)	**524**		**521**			**50.6 %**	**2.48 [-3.60, 8.56]**
Heterogeneity: Tau² = 47.36; Chi² = 34.80, df = 5 (P<0.00001); I² =86%							
Test for overall effect: Z = 0.80 (P = 0.42)							
2 Intramedullary hip screw (IMHS)							
Baumgaertner 1998	67	72 (33)	68	80 (35)		7.9 %	-8.00 [-19.47, 3.47]
Hardy 1998	50	71 (28.9)	50	57 (24.8)		8.0 %	14.00 [3.44, 24.56]
Harrington 2002	50	108 (26.8)	52	88 (27.5)		8.0 %	20.00 [9.46, 30.54]
Subtotal (95% CI)	**167**		**170**			**24.0 %**	**8.81 [-7.43, 25.05]**
Heterogeneity: Tau² = 175.30; Chi² = 13.45, df = 2 (P = 0.001); I² =85%							
Test for overall effect: Z = 1.06 (P = 0.29)							
3 Proximal femoral nail (PFN)							
Saudan 2002	100	64 (33)	106	65 (26)		8.3 %	-1.00 [-9.14, 7.14]
Subtotal (95% CI)	**100**		**106**			**8.3 %**	**-1.00 [-9.14, 7.14]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.24 (P = 0.81)							



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Study or subgroup	Femoral nail N	Femoral nail Mean(SD)	Sliding hip screw N	Sliding hip screw Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
5 Holland nail							
Little 2008	92	54 (23)	98	40.3 (14.9)		8.5 %	13.70 [8.15, 19.25]
Subtotal (95% CI)	**92**		**98**			**8.5 %**	**13.70 [8.15, 19.25]**
Heterogeneity: not applicable							
Test for overall effect: Z = 4.84 (P < 0.00001)							
6 Proximal femoral nail antirotation							
Zou 2009	58	52 (10)	63	93 (13)		8.6 %	-41.00 [-45.11, -36.89]
Subtotal (95% CI)	**58**		**63**			**8.6 %**	**-41.00 [-45.11, -36.89]**
Heterogeneity: not applicable							
Test for overall effect: Z = 19.53 (P < 0.00001)							
Total (95% CI)	**941**		**958**			**100.0 %**	**1.15 [-9.85, 12.16]**
Heterogeneity: Tau^2 = 362.81; Chi^2 = 431.46, df = 11 (P<0.00001); I^2 =97%							
Test for overall effect: Z = 0.21 (P = 0.84)							

-100 -50 0 50 100

Favours nail Favours SHS

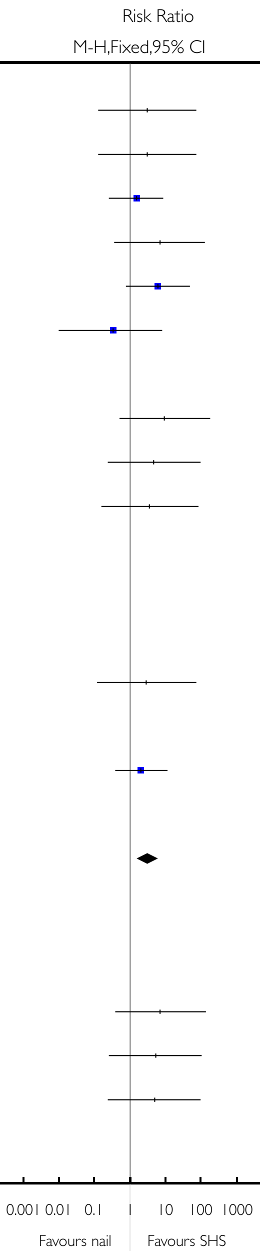
Analysis 1.2. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 2 Operative fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 2 Operative fracture of the femur

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 8)			
Bridle 1991	1/49	0/51	3.12 [0.13, 74.80]
Guyer 1991	1/50	0/50	3.00 [0.13, 71.92]
Leung 1992	3/93	2/93	1.50 [0.26, 8.77]
Mott 1993	3/35	0/34	6.81 [0.36, 127.00]
Radford 1993	6/100	1/100	6.00 [0.74, 48.94]
Ahrengart 1994	0/105	1/104	0.33 [0.01, 8.01]
Goldhagen 1994	0/36	0/39	0.0 [0.0, 0.0]
Benum 1994	4/226	0/234	9.32 [0.50, 172.07]
O'Brien 1995	2/53	0/49	4.63 [0.23, 94.10]
Hoffman 1996	1/31	0/36	3.47 [0.15, 82.21]
Kukla 1997	0/60	0/60	0.0 [0.0, 0.0]
Park 1998	0/30	0/30	0.0 [0.0, 0.0]
Kuwabara 1998	0/20	0/23	0.0 [0.0, 0.0]
Adams 2001	1/203	0/197	2.91 [0.12, 71.05]
Marques Lopez 2002	0/43	0/60	0.0 [0.0, 0.0]
Utrilla 2005	4/104	2/106	2.04 [0.38, 10.89]
Ovesen 2006	0/73	0/73	0.0 [0.0, 0.0]
Subtotal (95% CI)	**1311**	**1339**	**3.02 [1.48, 6.14]**
Total events: 26 (Femoral nail), 6 (Sliding hip screw)			
Heterogeneity: $Chi^2 = 4.03$, df = 10 (P = 0.95); I^2 =0.0%			
Test for overall effect: Z = 3.05 (P = 0.0023)			
2 Intramedullary hip screw (IMHS)			
Hardy 1998	3/50	0/50	7.00 [0.37, 132.10]
Baumgaertner 1998	2/67	0/68	5.07 [0.25, 103.74]
Hoffmann 1999	2/56	0/54	4.82 [0.24, 98.24]
Mehdi 2000	0/90	0/90	0.0 [0.0, 0.0]



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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**313**	**314**		**5.01 [1.11, 22.65]**
Total events: 8 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.14$, $df = 3$ ($P = 0.99$); $I^2 = 0.0\%$				
Test for overall effect: $Z = 2.09$ ($P = 0.036$)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)				
Saudan 2002	0/100	0/106		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**106**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.0$ ($P < 0.00001$)				
7 Long Gamma nail				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**110**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.0$ ($P < 0.00001$)				
8 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	1/80	0/40		1.52 [0.06, 36.46]
Subtotal (95% CI)	**80**	**40**		**1.52 [0.06, 36.46]**
Total events: 1 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.26$ ($P = 0.80$)				
9 Two nail types (Gamma or Endovis BA nail)				
Verettas 2010	2/59	1/59		2.00 [0.19, 21.46]
Subtotal (95% CI)	**59**	**59**		**2.00 [0.19, 21.46]**
Total events: 2 (Femoral nail), 1 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.57$ ($P = 0.57$)				
Total (95% CI)	**1963**	**1968**		**3.16 [1.73, 5.79]**
Total events: 37 (Femoral nail), 7 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 4.89$, $df = 16$ ($P = 1.00$); $I^2 = 0.0\%$				
Test for overall effect: $Z = 3.74$ ($P = 0.00019$)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

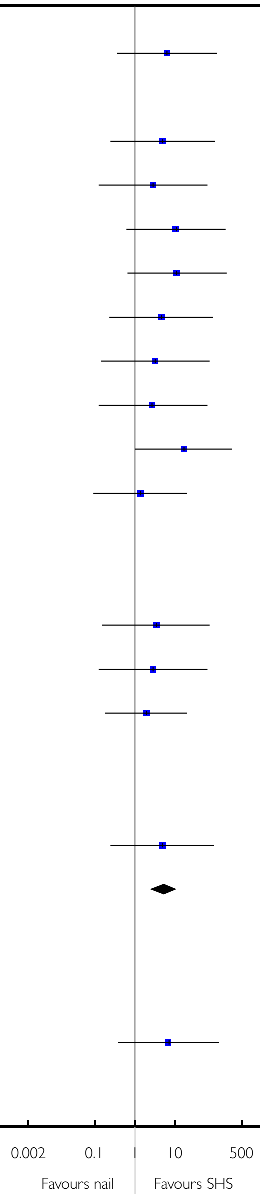
Analysis 1.3. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 3 Later fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 3 Later fracture of the femur

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 8)			
Bridle 1991	3/34	0/32	6.60 [0.35, 122.96]
Guyer 1991	0/50	0/50	0.0 [0.0, 0.0]
Leung 1992	2/93	0/93	5.00 [0.24, 102.75]
Mott 1993	1/35	0/34	2.92 [0.12, 69.20]
Radford 1993	5/100	0/100	11.00 [0.62, 196.33]
Benum 1994	5/226	0/234	11.39 [0.63, 204.76]
Ahrengart 1994	2/87	0/81	4.66 [0.23, 95.61]
Goldhagen 1994	1/36	0/39	3.24 [0.14, 77.15]
O'Brien 1995	1/53	0/49	2.78 [0.12, 66.62]
Butt 1995	8/47	0/48	17.35 [1.03, 292.39]
Hoffman 1996	1/23	1/31	1.35 [0.09, 20.44]
Kukla 1997	0/45	0/44	0.0 [0.0, 0.0]
Park 1998	0/30	0/30	0.0 [0.0, 0.0]
Kuwabara 1998	1/20	0/23	3.43 [0.15, 79.74]
Michos 2001	1/25	0/24	2.88 [0.12, 67.53]
Adams 2001	2/203	1/197	1.94 [0.18, 21.23]
Marques Lopez 2002	0/30	0/38	0.0 [0.0, 0.0]
Utrilla 2005	0/82	0/81	0.0 [0.0, 0.0]
Ovesen 2006	2/73	0/73	5.00 [0.24, 102.38]
Subtotal (95% CI)	**1292**	**1301**	**5.23 [2.46, 11.14]**
Total events: 35 (Femoral nail), 2 (Sliding hip screw)			
Heterogeneity: Chi^2 = 3.45, df = 13 (P = 1.00); I^2 =0.0%			
Test for overall effect: Z = 4.29 (P = 0.000018)			
2 Intramedullary hip screw (IMHS)			
Baumgaertner 1998	3/67	0/68	7.10 [0.37, 134.92]
Hardy 1998	0/50	0/50	0.0 [0.0, 0.0]



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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**223**	**224**		**5.12 [0.61, 43.33]**
Total events: 4 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.14$, df = 1 (P = 0.71); I^2 =0.0%				
Test for overall effect: Z = 1.50 (P = 0.13)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Subtotal (95% CI)	**54**	**54**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
4 Targon PF nail				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
Subtotal (95% CI)	**34**	**26**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
5 Holland nail				
Little 2008	0/92	0/98		0.0 [0.0, 0.0]
Subtotal (95% CI)	**92**	**98**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
6 Proximal femoral nail antirotation				
Zou 2009	0/58	0/63		0.0 [0.0, 0.0]
Subtotal (95% CI)	**58**	**63**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
7 Long Gamma nail				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**110**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
8 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	0/80	0/40		0.0 [0.0, 0.0]
Subtotal (95% CI)	**80**	**40**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				

0.002 0.1 1 10 500

Favours nail Favours SHS

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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**1933**	**1916**		**5.22 [2.56, 10.64]**
Total events: 39 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: Chi^2 = 3.59, df = 15 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 4.55 (P < 0.00001)				

0.002 0.1 1 10 500

Favours nail Favours SHS

Analysis 1.4. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 4 Cut-out (overall denominators used).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 4 Cut-out (overall denominators used)

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 8)				
Bridle 1991	2/49	3/51		0.69 [0.12, 3.98]
Guyer 1991	1/50	3/50		0.33 [0.04, 3.10]
Leung 1992	2/113	3/113		0.67 [0.11, 3.91]
Radford 1993	2/100	3/100		0.67 [0.11, 3.90]
Mott 1993	3/35	1/34		2.91 [0.32, 26.66]
Ahrengart 1994	3/105	3/104		0.99 [0.20, 4.80]
Benum 1994	5/226	2/234		2.59 [0.51, 13.21]
Goldhagen 1994	2/36	0/39		5.41 [0.27, 108.93]
O'Brien 1995	3/53	1/49		2.77 [0.30, 25.78]
Haynes 1996	2/19	3/31		1.09 [0.20, 5.93]
Hoffman 1996	1/31	1/36		1.16 [0.08, 17.80]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Kuwabara 1998	1/20	1/23		1.15 [0.08, 17.22]

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

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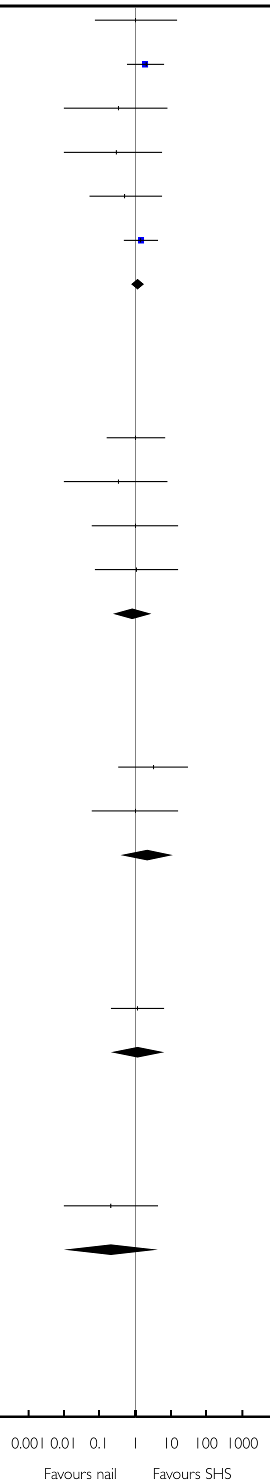
Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Adams 2001	8/203	4/197		1.94 [0.59, 6.34]
Michos 2001	0/26	1/26		0.33 [0.01, 7.82]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Utrilla 2005	1/104	2/106		0.51 [0.05, 5.53]
Ovesen 2006	7/73	5/73		1.40 [0.47, 4.21]
Subtotal (95% CI)	**1376**	**1416**		**1.18 [0.77, 1.79]**
Total events: 44 (Femoral nail), 39 (Sliding hip screw)				
Heterogeneity: Chi^2 = 8.30, df = 17 (P = 0.96); I^2 =0.0%				
Test for overall effect: Z = 0.76 (P = 0.45)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	2/67	2/68		1.01 [0.15, 7.00]
Hardy 1998	0/50	1/50		0.33 [0.01, 7.99]
Mehdi 2000	1/90	1/90		1.00 [0.06, 15.74]
Harrington 2002	1/50	1/52		1.04 [0.07, 16.18]
Subtotal (95% CI)	**257**	**260**		**0.83 [0.24, 2.84]**
Total events: 4 (Femoral nail), 5 (Sliding hip screw)				
Heterogeneity: Chi^2 = 0.40, df = 3 (P = 0.94); I^2 =0.0%				
Test for overall effect: Z = 0.30 (P = 0.77)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)				
Saudan 2002	3/100	1/106		3.18 [0.34, 30.07]
Pajarinen 2005	1/54	1/54		1.00 [0.06, 15.58]
Subtotal (95% CI)	**154**	**160**		**2.07 [0.39, 11.10]**
Total events: 4 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: Chi^2 = 0.41, df = 1 (P = 0.52); I^2 =0.0%				
Test for overall effect: Z = 0.85 (P = 0.39)				
4 Targon PF nail				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]
Subtotal (95% CI)	**34**	**26**		**1.15 [0.21, 6.37]**
Total events: 3 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.16 (P = 0.88)				
5 Holland nail				
Little 2008	0/92	2/98		0.21 [0.01, 4.38]
Subtotal (95% CI)	**92**	**98**		**0.21 [0.01, 4.38]**
Total events: 0 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 1.00 (P = 0.32)				
6 Proximal femoral nail antirotation				



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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Zou 2009	0/58	0/63		0.0 [0.0, 0.0]
Subtotal (95% CI)	**58**	**63**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
7 Long Gamma nail				
Barton 2010	3/100	2/110		1.65 [0.28, 9.67]
Subtotal (95% CI)	**100**	**110**		**1.65 [0.28, 9.67]**
Total events: 3 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.55 (P = 0.58)				
8 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	3/80	2/40		0.75 [0.13, 4.31]
Subtotal (95% CI)	**80**	**40**		**0.75 [0.13, 4.31]**
Total events: 3 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.32 (P = 0.75)				
Total (95% CI)	**2151**	**2173**		**1.13 [0.79, 1.60]**
Total events: 61 (Femoral nail), 54 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 11.29$, df = 27 (P = 1.00); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.66 (P = 0.51)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

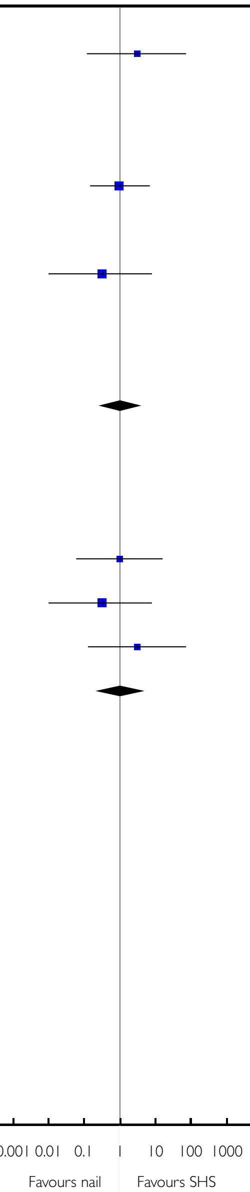
Analysis 1.5. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 5 Non-union (overall denominators used).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 5 Non-union (overall denominators used)

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 8)				
Leung 1992	1/113	0/113		3.00 [0.12, 72.87]
Radford 1993	0/100	0/100		0.0 [0.0, 0.0]
Goldhagen 1994	0/36	0/39		0.0 [0.0, 0.0]
Ahrengart 1994	2/105	2/104		0.99 [0.14, 6.90]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Park 1998	0/30	1/30		0.33 [0.01, 7.87]
Michos 2001	0/26	0/26		0.0 [0.0, 0.0]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]
Subtotal (95% CI)	**543**	**545**		**1.00 [0.25, 3.93]**
Total events: 3 (Femoral nail), 3 (Sliding hip screw)				
Heterogeneity: Chi² = 0.92, df = 2 (P = 0.63); I² =0.0%				
Test for overall effect: Z = 0.01 (P = 0.99)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	1/67	1/68		1.01 [0.06, 15.90]
Hardy 1998	0/35	1/35		0.33 [0.01, 7.91]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**152**	**155**		**1.02 [0.21, 4.95]**
Total events: 2 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: Chi² = 0.95, df = 2 (P = 0.62); I² =0.0%				
Test for overall effect: Z = 0.02 (P = 0.98)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)				
Saudan 2002	0/100	0/106		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**106**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
4 Targon PF nail				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
Subtotal (95% CI)	**34**	**26**		**0.0 [0.0, 0.0]**



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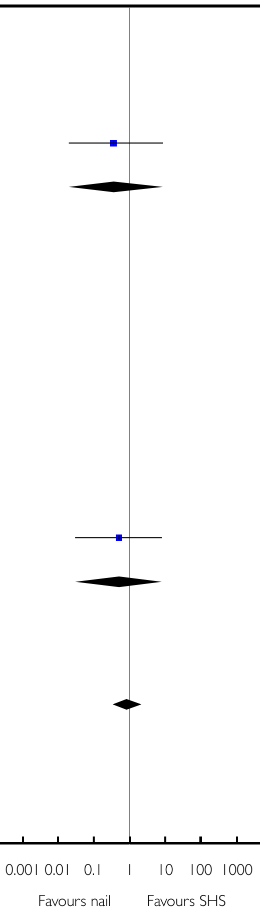
Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
6 Proximal femoral nail antirotation				
Zou 2009	0/58	1/63		0.36 [0.02, 8.70]
Subtotal (95% CI)	**58**	**63**		**0.36 [0.02, 8.70]**
Total events: 0 (Femoral nail), 1 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.63 (P = 0.53)				
7 Long Gamma nail				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**110**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
8 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	1/80	1/40		0.50 [0.03, 7.79]
Subtotal (95% CI)	**80**	**40**		**0.50 [0.03, 7.79]**
Total events: 1 (Femoral nail), 1 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.49 (P = 0.62)				
Total (95% CI)	**1067**	**1045**		**0.84 [0.34, 2.10]**
Total events: 6 (Femoral nail), 7 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 2.37$, df = 7 (P = 0.94); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.37 (P = 0.71)				



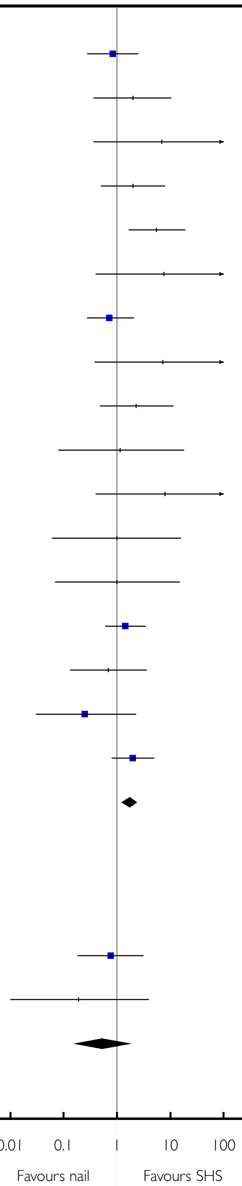
Analysis 1.6. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 6 Reoperation (overall denominators used).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 6 Reoperation (overall denominators used)

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 8)					
Guyer 1991	5/50	6/50		8.1 %	0.83 [0.27, 2.55]
Leung 1992	4/113	2/113		2.7 %	2.00 [0.37, 10.70]
Mott 1993	3/35	0/34		0.7 %	6.81 [0.36, 127.00]
Radford 1993	6/100	3/100		4.1 %	2.00 [0.51, 7.78]
Benum 1994	16/226	3/234		4.0 %	5.52 [1.63, 18.69]
Goldhagen 1994	3/36	0/39		0.7 %	7.57 [0.40, 141.62]
Ahrengart 1994	6/105	8/104		10.9 %	0.74 [0.27, 2.07]
Butt 1995	3/47	0/48		0.7 %	7.15 [0.38, 134.67]
O'Brien 1995	5/53	2/49		2.8 %	2.31 [0.47, 11.37]
Hoffman 1996	1/31	1/36		1.3 %	1.16 [0.08, 17.80]
Haynes 1996	2/19	0/31		0.5 %	8.00 [0.40, 158.22]
Kukla 1997	1/60	1/60		1.4 %	1.00 [0.06, 15.62]
Michos 2001	1/26	1/26		1.4 %	1.00 [0.07, 15.15]
Adams 2001	12/203	8/197		11.0 %	1.46 [0.61, 3.48]
Marques Lopez 2002	2/43	4/60		4.5 %	0.70 [0.13, 3.64]
Utrilla 2005	1/104	4/106		5.4 %	0.25 [0.03, 2.24]
Ovesen 2006	12/73	6/73		8.1 %	2.00 [0.79, 5.04]
Subtotal (95% CI)	**1324**	**1360**		**68.2 %**	**1.71 [1.22, 2.40]**
Total events: 83 (Femoral nail), 49 (Sliding hip screw)					
Heterogeneity: Chi^2 = 16.38, df = 16 (P = 0.43); I^2 =2%					
Test for overall effect: Z = 3.11 (P = 0.0018)					
2 Intramedullary hip screw (IMHS)					
Hardy 1998	3/50	4/50		5.4 %	0.75 [0.18, 3.18]
Hoffmann 1999	0/56	2/54		3.5 %	0.19 [0.01, 3.93]
Subtotal (95% CI)	**106**	**104**		**8.9 %**	**0.53 [0.15, 1.88]**
Total events: 3 (Femoral nail), 6 (Sliding hip screw)					



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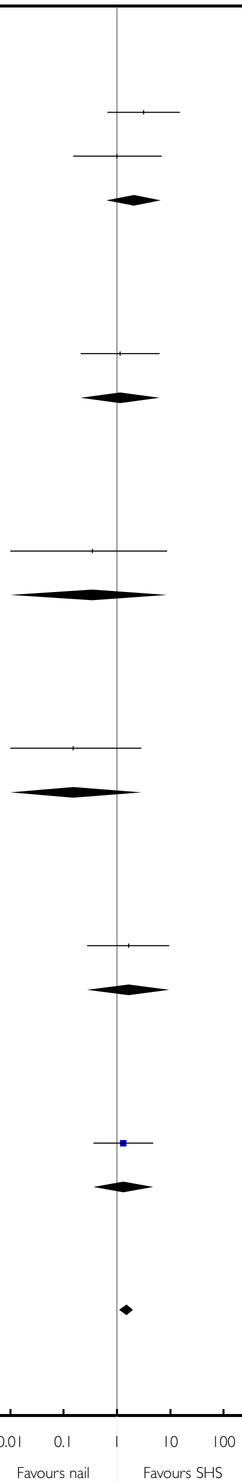
Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Weight	Risk Ratio M-H,Fixed,95% CI
Heterogeneity: Chi^2 = 0.65, df = 1 (P = 0.42); I^2 =0.0%				
Test for overall effect: Z = 0.98 (P = 0.33)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 8)				
Saudan 2002	6/100	2/106	2.6 %	3.18 [0.66, 15.39]
Pajarinen 2005	2/54	2/54	2.7 %	1.00 [0.15, 6.84]
Subtotal (95% CI)	**154**	**160**	**5.3 %**	**2.07 [0.64, 6.73]**
Total events: 8 (Femoral nail), 4 (Sliding hip screw)				
Heterogeneity: Chi^2 = 0.83, df = 1 (P = 0.36); I^2 =0.0%				
Test for overall effect: Z = 1.22 (P = 0.22)				
4 Targon PF nail				
Giraud 2005	3/34	2/26	3.1 %	1.15 [0.21, 6.37]
Subtotal (95% CI)	**34**	**26**	**3.1 %**	**1.15 [0.21, 6.37]**
Total events: 3 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.16 (P = 0.88)				
5 Holland nail				
Little 2008	0/92	1/98	2.0 %	0.35 [0.01, 8.60]
Subtotal (95% CI)	**92**	**98**	**2.0 %**	**0.35 [0.01, 8.60]**
Total events: 0 (Femoral nail), 1 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.64 (P = 0.52)				
6 Proximal femoral nail antirotation				
Zou 2009	0/58	3/63	4.6 %	0.15 [0.01, 2.94]
Subtotal (95% CI)	**58**	**63**	**4.6 %**	**0.15 [0.01, 2.94]**
Total events: 0 (Femoral nail), 3 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 1.24 (P = 0.21)				
7 Long Gamma nail				
Barton 2010	3/100	2/110	2.6 %	1.65 [0.28, 9.67]
Subtotal (95% CI)	**100**	**110**	**2.6 %**	**1.65 [0.28, 9.67]**
Total events: 3 (Femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.55 (P = 0.58)				
8 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	8/80	3/40	5.4 %	1.33 [0.37, 4.75]
Subtotal (95% CI)	**80**	**40**	**5.4 %**	**1.33 [0.37, 4.75]**
Total events: 8 (Femoral nail), 3 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.44 (P = 0.66)				
Total (95% CI)	**1948**	**1961**	**100.0 %**	**1.49 [1.12, 1.98]**
Total events: 108 (Femoral nail), 70 (Sliding hip screw)				
Heterogeneity: Chi^2 = 23.16, df = 25 (P = 0.57); I^2 =0.0%				

Risk Ratio M-H,Fixed,95% CI



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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 2.71 (P = 0.0066)					

0.01 0.1 1 10 100
Favours nail Favours SHS

Analysis 1.7. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 7 Deep wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 7 Deep wound infection

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Guyer 1991	0/50	1/50		0.33 [0.01, 7.99]
Leung 1992	1/93	3/93		0.33 [0.04, 3.15]
Radford 1993	1/100	0/100		3.00 [0.12, 72.77]
Mott 1993	0/35	0/34		0.0 [0.0, 0.0]
Ahrengart 1994	0/105	1/104		0.33 [0.01, 8.01]
O'Brien 1995	0/53	0/49		0.0 [0.0, 0.0]
Hoffman 1996	0/31	0/36		0.0 [0.0, 0.0]
Kukla 1997	2/60	0/60		5.00 [0.25, 102.00]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Adams 2001	3/203	2/197		1.46 [0.25, 8.62]
Utrilla 2005	0/104	1/106		0.34 [0.01, 8.24]
Ovesen 2006	2/73	1/73		2.00 [0.19, 21.58]
Subtotal (95% CI)	**937**	**932**		**0.99 [0.46, 2.17]**
Total events: 10 (Femoral nail), 10 (Sliding hip screw)				
Heterogeneity: Chi^2 = 4.33, df = 8 (P = 0.83); I^2 =0.0%				
Test for overall effect: Z = 0.01 (P = 0.99)				
2 Intramedullary hip screw (IMHS)				

0.001 0.01 0.1 1 10 100 1000
Favours nail Favours SHS

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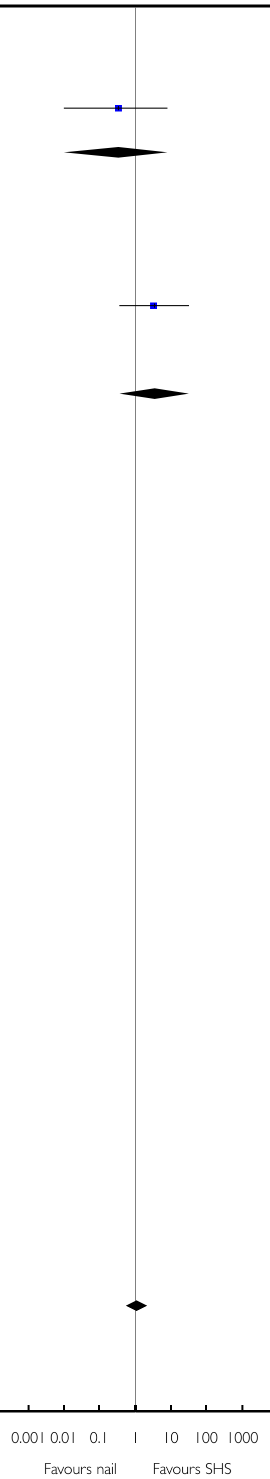
Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Hardy 1998	0/50	0/50		0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Mehdi 2000	0/90	1/90		0.33 [0.01, 8.08]
Subtotal (95% CI)	**196**	**194**		**0.33 [0.01, 8.08]**
Total events: 0 (Femoral nail), 1 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.0$, $df = 0$ ($P = 1.00$); $I^2 = 0.0\%$				
Test for overall effect: $Z = 0.68$ ($P = 0.50$)				
3 Proximal femoral nail (PFN)				
Saudan 2002	3/79	1/89		3.38 [0.36, 31.84]
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Subtotal (95% CI)	**133**	**143**		**3.38 [0.36, 31.84]**
Total events: 3 (Femoral nail), 1 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.0$, $df = 0$ ($P = 1.00$); $I^2 = 0.0\%$				
Test for overall effect: $Z = 1.06$ ($P = 0.29$)				
4 Targon PF nail				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
Subtotal (95% CI)	**34**	**26**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.0$ ($P < 0.00001$)				
5 Holland nail				
Little 2008	0/92	0/98		0.0 [0.0, 0.0]
Subtotal (95% CI)	**92**	**98**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.0$ ($P < 0.00001$)				
6 Proximal femoral nail antirotation				
Zou 2009	0/58	0/63		0.0 [0.0, 0.0]
Subtotal (95% CI)	**58**	**63**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.0$ ($P < 0.00001$)				
7 Long Gamma nail				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**110**		**0.0 [0.0, 0.0]**
Total events: 0 (Femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: $Z = 0.0$ ($P < 0.00001$)				
Total (95% CI)	**1550**	**1566**		**1.08 [0.54, 2.17]**
Total events: 13 (Femoral nail), 12 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 5.89$, $df = 10$ ($P = 0.82$); $I^2 = 0.0\%$				



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Study or subgroup	Femoral nail	Sliding hip screw	Risk Ratio	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI	M-H,Fixed,95% CI
Test for overall effect: Z = 0.21 (P = 0.83)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

Analysis 1.8. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 8 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 8 Mortality

Study or subgroup	Femoral nail	Sliding hip screw	Risk Ratio	Weight	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI		M-H,Fixed,95% CI
1 Gamma nail					
Bridle 1991	15/49	19/51		5.5 %	0.82 [0.47, 1.43]
Guyer 1991	8/50	8/50		2.4 %	1.00 [0.41, 2.46]
Leung 1992	20/113	20/113		5.9 %	1.00 [0.57, 1.75]
Radford 1993	12/100	10/100		3.0 %	1.20 [0.54, 2.65]
Pahlpatz 1993	6/51	10/53		2.9 %	0.62 [0.24, 1.59]
Ahrengart 1994	18/105	23/104		6.8 %	0.78 [0.45, 1.35]
Goldhagen 1994	2/36	1/39		0.3 %	2.17 [0.21, 22.89]
O'Brien 1995	6/52	1/49		0.3 %	5.65 [0.71, 45.29]
Butt 1995	5/47	2/48		0.6 %	2.55 [0.52, 12.52]
Haynes 1996	1/19	8/31		1.8 %	0.20 [0.03, 1.51]
Hoffman 1996	8/31	5/36		1.4 %	1.86 [0.68, 5.10]
Kukla 1997	14/60	14/60		4.1 %	1.00 [0.52, 1.91]
Adams 2001	59/203	61/197		18.3 %	0.94 [0.70, 1.27]
Marques Lopez 2002	13/43	22/60		5.4 %	0.82 [0.47, 1.45]
Utrilla 2005	19/104	21/106		6.2 %	0.92 [0.53, 1.61]

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

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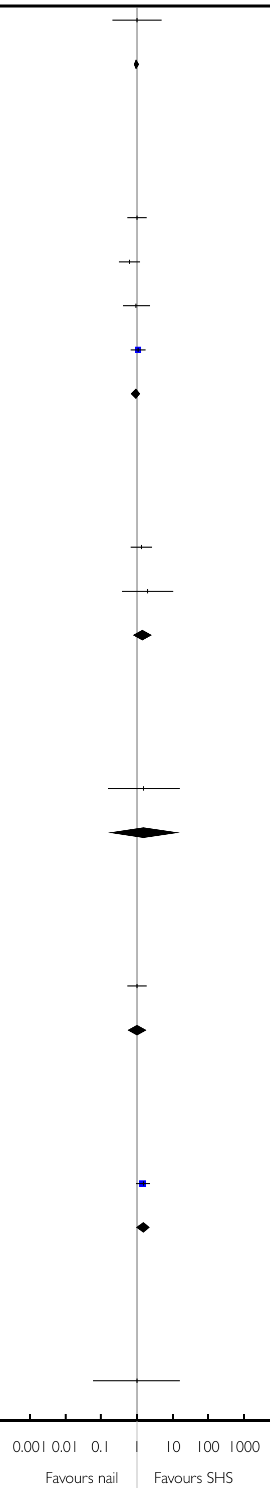
Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Ovesen 2006	3/73	3/73		0.9 %	1.00 [0.21, 4.79]
Subtotal (95% CI)	**1136**	**1170**		**65.8 %**	**0.95 [0.81, 1.12]**
Total events: 209 (Femoral nail), 228 (Sliding hip screw)					
Heterogeneity: Chi² = 10.99, df = 15 (P = 0.75); I² =0.0%					
Test for overall effect: Z = 0.59 (P = 0.56)					
2 Intramedullary hip screw (IMHS)					
Hardy 1998	15/50	15/50		4.4 %	1.00 [0.55, 1.82]
Baumgaertner 1998	10/65	17/66		5.0 %	0.60 [0.30, 1.21]
Hoffmann 1999	9/56	9/54		2.7 %	0.96 [0.41, 2.24]
Harrington 2002	20/50	19/52		5.5 %	1.09 [0.67, 1.79]
Subtotal (95% CI)	**221**	**222**		**17.6 %**	**0.91 [0.67, 1.24]**
Total events: 54 (Femoral nail), 60 (Sliding hip screw)					
Heterogeneity: Chi² = 2.03, df = 3 (P = 0.57); I² =0.0%					
Test for overall effect: Z = 0.59 (P = 0.55)					
3 Proximal femoral nail (PFN)					
Saudan 2002	16/100	13/106		3.7 %	1.30 [0.66, 2.57]
Pajarinen 2005	4/54	2/54		0.6 %	2.00 [0.38, 10.47]
Subtotal (95% CI)	**154**	**160**		**4.3 %**	**1.40 [0.75, 2.62]**
Total events: 20 (Femoral nail), 15 (Sliding hip screw)					
Heterogeneity: Chi² = 0.22, df = 1 (P = 0.64); I² =0.0%					
Test for overall effect: Z = 1.05 (P = 0.29)					
4 Targon PF nail					
Giraud 2005	2/34	1/26		0.3 %	1.53 [0.15, 15.97]
Subtotal (95% CI)	**34**	**26**		**0.3 %**	**1.53 [0.15, 15.97]**
Total events: 2 (Femoral nail), 1 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.36 (P = 0.72)					
5 Holland nail					
Little 2008	16/92	17/98		4.9 %	1.00 [0.54, 1.86]
Subtotal (95% CI)	**92**	**98**		**4.9 %**	**1.00 [0.54, 1.86]**
Total events: 16 (Femoral nail), 17 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.01 (P = 0.99)					
7 Long Gamma nail					
Barton 2010	32/100	24/110		6.8 %	1.47 [0.93, 2.31]
Subtotal (95% CI)	**100**	**110**		**6.8 %**	**1.47 [0.93, 2.31]**
Total events: 32 (Femoral nail), 24 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.65 (P = 0.099)					
8 Two nail types (Gamma or Endovis BA nail)					
Verettas 2010	1/59	1/59		0.3 %	1.00 [0.06, 15.61]



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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**59**	**59**		**0.3 %**	**1.00 [0.06, 15.61]**
Total events: 1 (Femoral nail), 1 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					
Total (95% CI)	**1796**	**1845**		**100.0 %**	**1.00 [0.88, 1.15]**
Total events: 334 (Femoral nail), 346 (Sliding hip screw)					
Heterogeneity: Chi^2 = 17.80, df = 25 (P = 0.85); I^2 =0.0%					
Test for overall effect: Z = 0.05 (P = 0.96)					

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

Analysis 1.9. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 9 Pain at follow-up.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 9 Pain at follow-up

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Guyer 1991	19/28	18/32		11.2 %	1.21 [0.81, 1.80]
Leung 1992	22/93	32/93		21.4 %	0.69 [0.43, 1.09]
Ahrengart 1994	25/88	15/83		10.3 %	1.57 [0.89, 2.77]
Hoffman 1996	9/23	9/31		5.1 %	1.35 [0.64, 2.85]
Utrilla 2005	50/82	45/81		30.3 %	1.10 [0.85, 1.42]
Subtotal (95% CI)	**314**	**320**		**78.4 %**	**1.08 [0.90, 1.30]**
Total events: 125 (Femoral nail), 119 (Sliding hip screw)					
Heterogeneity: Chi^2 = 6.03, df = 4 (P = 0.20); I^2 =34%					
Test for overall effect: Z = 0.81 (P = 0.42)					
2 Intramedullary hip screw (IMHS)					
Baumgaertner 1998	15/52	12/53		8.0 %	1.27 [0.66, 2.45]
Hardy 1998	9/35	4/35		2.7 %	2.25 [0.76, 6.63]

0.1 0.2 0.5 1 2 5 10

Favours nail Favours SHS

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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Hoffmann 1999	14/45	16/43		11.0 %	0.84 [0.47, 1.50]
Subtotal (95% CI)	**132**	**131**		**21.6 %**	**1.17 [0.79, 1.75]**
Total events: 38 (Femoral nail), 32 (Sliding hip screw)					
Heterogeneity: $Chi^2 = 2.75$, df = 2 (P = 0.25); $I^2 = 27\%$					
Test for overall effect: Z = 0.78 (P = 0.43)					
Total (95% CI)	**446**	**451**		**100.0 %**	**1.10 [0.93, 1.30]**
Total events: 163 (Femoral nail), 151 (Sliding hip screw)					
Heterogeneity: $Chi^2 = 8.75$, df = 7 (P = 0.27); $I^2 = 20\%$					
Test for overall effect: Z = 1.10 (P = 0.27)					

0.1 0.2 0.5 1 2 5 10

Favours nail Favours SHS

Analysis 1.10. Comparison 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS), Outcome 10 Non return to previous residence or dead.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Summary: Femoral nail (all types) versus sliding hip screw (SHS)

Outcome: 10 Non return to previous residence or dead

Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Guyer 1991	11/36	11/40		4.6 %	1.11 [0.55, 2.25]
Pahlpatz 1993	17/51	21/53		9.1 %	0.84 [0.50, 1.40]
Ahrengart 1994	43/105	43/104		19.2 %	0.99 [0.72, 1.37]
Haynes 1996	4/19	15/31		5.1 %	0.44 [0.17, 1.12]
Subtotal (95% CI)	**211**	**228**		**38.0 %**	**0.90 [0.70, 1.15]**
Total events: 75 (Femoral nail), 90 (Sliding hip screw)					
Heterogeneity: $Chi^2 = 3.04$, df = 3 (P = 0.39); $I^2 = 1\%$					
Test for overall effect: Z = 0.88 (P = 0.38)					
2 Intramedullary hip screw (IMHS)					
Baumgaertner 1998	24/58	25/64		10.6 %	1.06 [0.69, 1.63]
Hoffmann 1999	16/54	16/52		7.2 %	0.96 [0.54, 1.72]

0.1 0.2 0.5 1 2 5 10

Favours nail Favours SHS

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Study or subgroup	Femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Harrington 2002	31/50	30/52		13.1 %	1.07 [0.78, 1.48]
Subtotal (95% CI)	**162**	**168**		**30.8 %**	**1.04 [0.82, 1.33]**
Total events: 71 (Femoral nail), 71 (Sliding hip screw)					
Heterogeneity: Chi^2 = 0.11, df = 2 (P = 0.95); I^2 =0.0%					
Test for overall effect: Z = 0.34 (P = 0.73)					
3 Proximal femoral nail (PFN)					
Saudan 2002	58/95	52/102		22.3 %	1.20 [0.93, 1.54]
Pajarinen 2005	18/52	20/52		8.9 %	0.90 [0.54, 1.50]
Subtotal (95% CI)	**147**	**154**		**31.1 %**	**1.11 [0.89, 1.39]**
Total events: 76 (Femoral nail), 72 (Sliding hip screw)					
Heterogeneity: Chi^2 = 1.01, df = 1 (P = 0.32); I^2 =1%					
Test for overall effect: Z = 0.93 (P = 0.35)					
Total (95% CI)	**520**	**550**		**100.0 %**	**1.01 [0.88, 1.16]**
Total events: 222 (Femoral nail), 233 (Sliding hip screw)					
Heterogeneity: Chi^2 = 5.87, df = 8 (P = 0.66); I^2 =0.0%					
Test for overall effect: Z = 0.12 (P = 0.90)					

0.1 0.2 0.5 1 2 5 10

Favours nail Favours SHS

Analysis 2.1. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

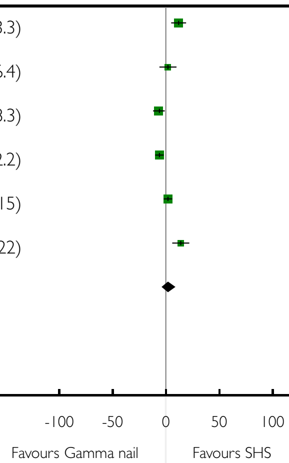
Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Gamma nail N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
O'Brien 1995	53	59 (23.9)	49	47 (13.3)		15.6 %	12.00 [4.57, 19.43]
Hoffman 1996	31	56.7 (17)	36	54.3 (16.4)		15.0 %	2.40 [-5.63, 10.43]
Kukla 1997	60	47.1 (20.8)	60	53.4 (8.3)		17.3 %	-6.30 [-11.97, -0.63]
Adams 2001	203	55.4 (20)	197	61.3 (22.2)		18.5 %	-5.90 [-10.04, -1.76]
Utrilla 2005	104	46 (11)	106	44 (15)		19.0 %	2.00 [-1.55, 5.55]
Ovesen 2006	73	65 (29)	73	51 (22)		14.7 %	14.00 [5.65, 22.35]
Total (95% CI)	**524**		**521**			**100.0 %**	**2.48 [-3.60, 8.56]**

Heterogeneity: $Tau^2 = 47.36$; $Chi^2 = 34.80$, df = 5 (P<0.00001); I^2 =86%

Test for overall effect: Z = 0.80 (P = 0.42)



Analysis 2.2. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 2 Blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

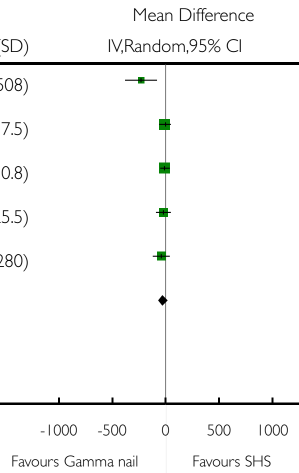
Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 2 Blood loss (ml)

Study or subgroup	Gamma nail N	Gamma nail Mean(SD)	SHS N	SHS Mean(SD)	Weight	Mean Difference IV,Random,95% CI
Leung 1992	93	814 (548)	93	1043 (508)	7.0 %	-229.00 [-380.87, -77.13]
O'Brien 1995	52	258.7 (145.4)	49	259.2 (137.5)	25.1 %	-0.50 [-55.67, 54.67]
Kukla 1997	60	152.3 (130.7)	60	160.3 (110.8)	29.5 %	-8.00 [-51.36, 35.36]
Adams 2001	203	244.4 (384.9)	197	260.4 (325.5)	20.3 %	-16.00 [-85.78, 53.78]
Ovesen 2006	73	240 (190)	73	280 (280)	18.1 %	-40.00 [-117.62, 37.62]
Total (95% CI)	**481**		**472**		**100.0 %**	**-29.04 [-73.17, 15.10]**

Heterogeneity: Tau^2 = 1230.33; Chi^2 = 8.31, df = 4 (P = 0.08); I^2 =52%

Test for overall effect: Z = 1.29 (P = 0.20)



Analysis 2.3. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 3 Number of people given transfusion.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

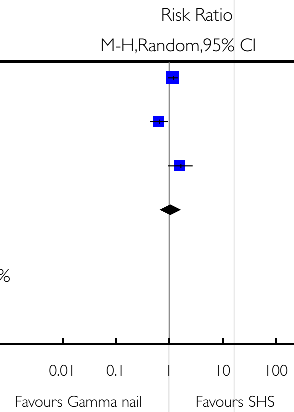
Outcome: 3 Number of people given transfusion

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Random,95% CI
Adams 2001	108/203	88/197	39.7 %	1.19 [0.97, 1.46]
Utrilla 2005	28/104	44/106	32.9 %	0.65 [0.44, 0.96]
Ovesen 2006	26/73	16/73	27.4 %	1.63 [0.95, 2.77]
Total (95% CI)	**380**	**376**	**100.0 %**	**1.06 [0.67, 1.68]**

Total events: 162 (Gamma nail), 148 (SHS)

Heterogeneity: Tau^2 = 0.13; Chi^2 = 9.77, df = 2 (P = 0.01); I^2 =80%

Test for overall effect: Z = 0.25 (P = 0.80)



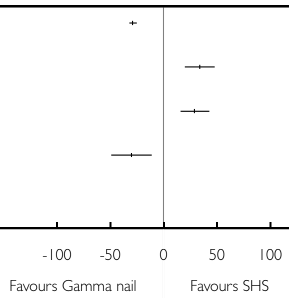
Analysis 2.4. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 4 Radiographic screening time (seconds).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 4 Radiographic screening time (seconds)

Study or subgroup	Gamma nail N	Gamma nail Mean(SD)	SHS N	SHS Mean(SD)	Mean Difference IV,Fixed,95% CI
Leung 1992	93	38.2 (8.7)	93	66.9 (13.7)	-28.70 [-32.00, -25.40]
O'Brien 1995	48	60 (46.2)	43	26 (18)	34.00 [19.87, 48.13]
Hoffman 1996	31	70.2 (33.6)	36	40.8 (21)	29.40 [15.73, 43.07]
Utrilla 2005	104	132 (72)	106	162 (72)	-30.00 [-49.48, -10.52]



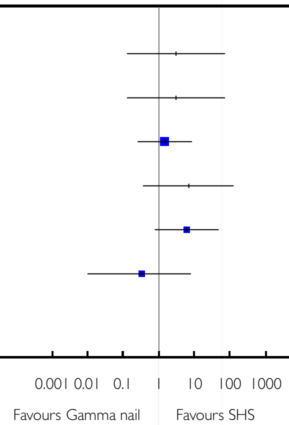
Analysis 2.5. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 5 Operative fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 5 Operative fracture of femur

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Gamma 1 nail			
Bridle 1991	1/49	0/51	3.12 [0.13, 74.80]
Guyer 1991	1/50	0/50	3.00 [0.13, 71.92]
Leung 1992	3/93	2/93	1.50 [0.26, 8.77]
Mott 1993	3/35	0/34	6.81 [0.36, 127.00]
Radford 1993	6/100	1/100	6.00 [0.74, 48.94]
Ahrengart 1994	0/105	1/104	0.33 [0.01, 8.01]
Goldhagen 1994	0/36	0/39	0.0 [0.0, 0.0]



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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Benum 1994	4/226	0/234		9.32 [0.50, 172.07]
O'Brien 1995	2/53	0/49		4.63 [0.23, 94.10]
Hoffman 1996	1/31	0/36		3.47 [0.15, 82.21]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Kuwabara 1998	0/20	0/23		0.0 [0.0, 0.0]
Adams 2001	1/203	0/197		2.91 [0.12, 71.05]
Marques Lopez 2002	0/43	0/60		0.0 [0.0, 0.0]
Subtotal (95% CI)	**1134**	**1160**		**3.26 [1.49, 7.16]**
Total events: 22 (Gamma nail), 4 (SHS)				
Heterogeneity: $Chi^2 = 3.85$, df = 9 (P = 0.92); I^2 =0.0%				
Test for overall effect: Z = 2.95 (P = 0.0032)				
2 Trochanteric Gamma nail				
Papasimos 2005	1/40	0/40		3.00 [0.13, 71.51]
Utrilla 2005	4/104	2/106		2.04 [0.38, 10.89]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]
Subtotal (95% CI)	**217**	**219**		**2.23 [0.51, 9.78]**
Total events: 5 (Gamma nail), 2 (SHS)				
Heterogeneity: $Chi^2 = 0.04$, df = 1 (P = 0.83); I^2 =0.0%				
Test for overall effect: Z = 1.07 (P = 0.29)				
Total (95% CI)	**1351**	**1379**		**3.02 [1.51, 6.03]**
Total events: 27 (Gamma nail), 6 (SHS)				
Heterogeneity: $Chi^2 = 4.03$, df = 11 (P = 0.97); I^2 =0.0%				
Test for overall effect: Z = 3.13 (P = 0.0018)				

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.6. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 6 Operative fracture of femur (reported experience with devices).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 6 Operative fracture of femur (reported experience with devices)

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Experienced surgeon (low risk of bias)				
Bridle 1991	1/49	0/51		3.12 [0.13, 74.80]
Radford 1993	6/100	1/100		6.00 [0.74, 48.94]
Ahrengart 1994	0/105	1/104		0.33 [0.01, 8.01]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Adams 2001	1/203	0/197		2.91 [0.12, 71.05]
Utrilla 2005	4/104	2/106		2.04 [0.38, 10.89]
Subtotal (95% CI)	**621**	**618**		**2.47 [0.92, 6.60]**
Total events: 12 (Gamma nail), 4 (SHS)				
Heterogeneity: $Chi^2 = 2.30$, df = 4 (P = 0.68); I^2 =0.0%				
Test for overall effect: Z = 1.80 (P = 0.071)				
2 Not experienced surgeon (high/unclear risk of bias)				
Guyer 1991	1/50	0/50		3.00 [0.13, 71.92]
Mott 1993	3/35	0/34		6.81 [0.36, 127.00]
Benum 1994	4/226	0/234		9.32 [0.50, 172.07]
Goldhagen 1994	0/36	0/39		0.0 [0.0, 0.0]
O'Brien 1995	2/53	0/49		4.63 [0.23, 94.10]
Hoffman 1996	1/31	0/36		3.47 [0.15, 82.21]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Kuwabara 1998	0/20	0/23		0.0 [0.0, 0.0]
Papasimos 2005	1/40	0/40		3.00 [0.13, 71.51]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]
Subtotal (95% CI)	**594**	**608**		**5.05 [1.47, 17.29]**
Total events: 12 (Gamma nail), 0 (SHS)				
Heterogeneity: $Chi^2 = 0.47$, df = 5 (P = 0.99); I^2 =0.0%				
Test for overall effect: Z = 2.58 (P = 0.010)				
3 Mixed experience (high risk of bias)				
Leung 1992	3/93	2/93		1.50 [0.26, 8.77]

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Marques Lopez 2002	0/43	0/60		0.0 [0.0, 0.0]
Subtotal (95% CI)	**136**	**153**		**1.50 [0.26, 8.77]**
Total events: 3 (Gamma nail), 2 (SHS)				
Heterogeneity: Chi² = 0.0, df = 0 (P = 1.00); I² =0.0%				
Test for overall effect: Z = 0.45 (P = 0.65)				
Total (95% CI)	**1351**	**1379**		**3.02 [1.51, 6.03]**
Total events: 27 (Gamma nail), 6 (SHS)				
Heterogeneity: Chi² = 4.03, df = 11 (P = 0.97); I² =0.0%				
Test for overall effect: Z = 3.13 (P = 0.0018)				

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.7. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 7 Later fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 7 Later fracture of femur

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Bridle 1991	3/34	0/32		6.60 [0.35, 122.96]
Guyer 1991	0/50	0/50		0.0 [0.0, 0.0]
Leung 1992	2/93	0/93		5.00 [0.24, 102.75]
Radford 1993	5/100	0/100		11.00 [0.62, 196.33]
Mott 1993	1/35	0/34		2.92 [0.12, 69.20]
Benum 1994	5/226	0/234		11.39 [0.63, 204.76]
Goldhagen 1994	1/36	0/39		3.24 [0.14, 77.15]
Ahrengart 1994	2/87	0/81		4.66 [0.23, 95.61]
O'Brien 1995	1/53	0/49		2.78 [0.12, 66.62]
Butt 1995	8/47	0/48		17.35 [1.03, 292.39]
Hoffman 1996	1/23	1/31		1.35 [0.09, 20.44]

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

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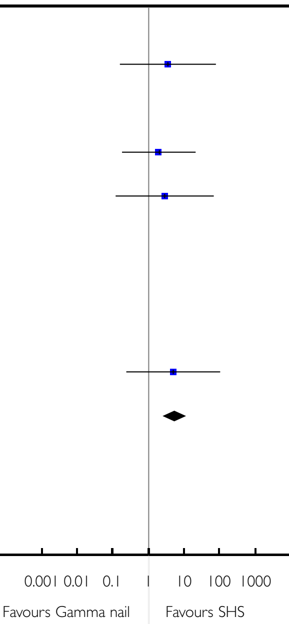
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Kukla 1997	0/45	0/44		0.0 [0.0, 0.0]
Kuwabara 1998	1/20	0/23		3.43 [0.15, 79.74]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Adams 2001	2/203	1/197		1.94 [0.18, 21.23]
Michos 2001	1/25	0/24		2.88 [0.12, 67.53]
Marques Lopez 2002	0/30	0/38		0.0 [0.0, 0.0]
Utrilla 2005	0/82	0/81		0.0 [0.0, 0.0]
Papasimos 2005	0/40	0/40		0.0 [0.0, 0.0]
Ovesen 2006	2/73	0/73		5.00 [0.24, 102.38]
Total (95% CI)	**1332**	**1341**		**5.23 [2.46, 11.14]**

Total events: 35 (Gamma nail), 2 (SHS)

Heterogeneity: Chi^2 = 3.45, df = 13 (P = 1.00); I^2 =0.0%

Test for overall effect: Z = 4.29 (P = 0.000018)



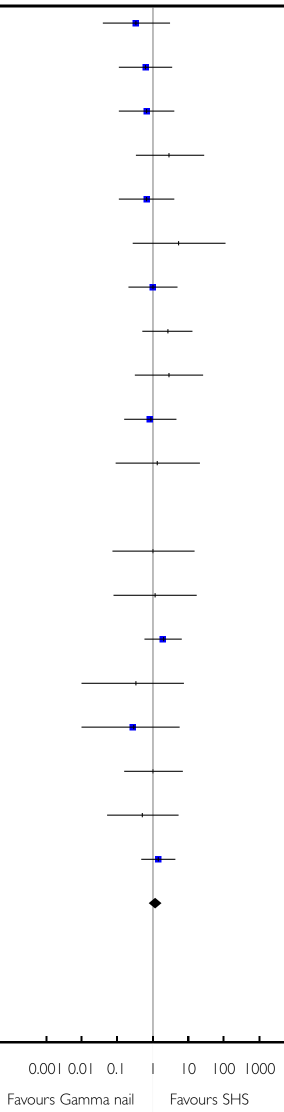
Analysis 2.8. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 8 Cut-out.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 8 Cut-out

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Guyer 1991	1/50	3/50		0.33 [0.04, 3.10]
Bridle 1991	2/34	3/32		0.63 [0.11, 3.51]
Leung 1992	2/93	3/93		0.67 [0.11, 3.90]
Mott 1993	3/35	1/34		2.91 [0.32, 26.66]
Radford 1993	2/100	3/100		0.67 [0.11, 3.90]
Goldhagen 1994	2/36	0/39		5.41 [0.27, 108.93]
Ahrengart 1994	3/105	3/104		0.99 [0.20, 4.80]
Benum 1994	5/226	2/234		2.59 [0.51, 13.21]
O'Brien 1995	3/53	1/49		2.77 [0.30, 25.78]
Haynes 1996	2/18	3/23		0.85 [0.16, 4.57]
Hoffman 1996	1/23	1/31		1.35 [0.09, 20.44]
Kukla 1997	0/45	0/44		0.0 [0.0, 0.0]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Kuwabara 1998	1/20	1/23		1.15 [0.08, 17.22]
Adams 2001	8/203	4/197		1.94 [0.59, 6.34]
Michos 2001	0/25	1/24		0.32 [0.01, 7.50]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Papasimos 2005	2/40	2/40		1.00 [0.15, 6.76]
Utrilla 2005	1/82	2/81		0.49 [0.05, 5.34]
Ovesen 2006	7/73	5/73		1.40 [0.47, 4.21]
Total (95% CI)	**1334**	**1361**		**1.15 [0.76, 1.72]**



Total events: 46 (Gamma nail), 41 (SHS)

Heterogeneity: Chi^2 = 8.69, df = 18 (P = 0.97); I^2 =0.0%

Test for overall effect: Z = 0.66 (P = 0.51)

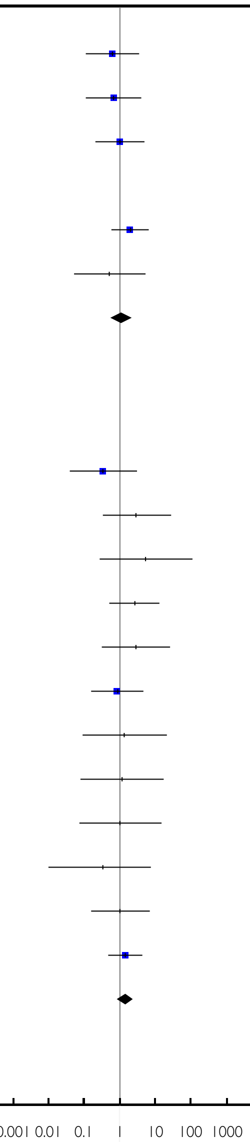
Analysis 2.9. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 9 Cut-out (reported experience with devices).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 9 Cut-out (reported experience with devices)

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Experienced surgeon (low risk of bias)			
Bridle 1991	2/34	3/32	0.63 [0.11, 3.51]
Radford 1993	2/100	3/100	0.67 [0.11, 3.90]
Ahrengart 1994	3/105	3/104	0.99 [0.20, 4.80]
Kukla 1997	0/45	0/44	0.0 [0.0, 0.0]
Adams 2001	8/203	4/197	1.94 [0.59, 6.34]
Utrilla 2005	1/82	2/81	0.49 [0.05, 5.34]
Subtotal (95% CI)	**569**	**558**	**1.04 [0.52, 2.08]**
Total events: 16 (Gamma nail), 15 (SHS)			
Heterogeneity: $Chi^2 = 2.02$, df = 4 (P = 0.73); $I^2 = 0.0\%$			
Test for overall effect: Z = 0.11 (P = 0.91)			
2 Not experienced surgeon (high/unclear risk of bias)			
Guyer 1991	1/50	3/50	0.33 [0.04, 3.10]
Mott 1993	3/35	1/34	2.91 [0.32, 26.66]
Goldhagen 1994	2/36	0/39	5.41 [0.27, 108.93]
Benum 1994	5/226	2/234	2.59 [0.51, 13.21]
O'Brien 1995	3/53	1/49	2.77 [0.30, 25.78]
Haynes 1996	2/18	3/23	0.85 [0.16, 4.57]
Hoffman 1996	1/23	1/31	1.35 [0.09, 20.44]
Kuwabara 1998	1/20	1/23	1.15 [0.08, 17.22]
Park 1998	1/30	1/30	1.00 [0.07, 15.26]
Michos 2001	0/25	1/24	0.32 [0.01, 7.50]
Papasimos 2005	2/40	2/40	1.00 [0.15, 6.76]
Ovesen 2006	7/73	5/73	1.40 [0.47, 4.21]
Subtotal (95% CI)	**629**	**650**	**1.37 [0.80, 2.36]**
Total events: 28 (Gamma nail), 21 (SHS)			
Heterogeneity: $Chi^2 = 5.06$, df = 11 (P = 0.93); $I^2 = 0.0\%$			



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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 1.15 (P = 0.25)				
3 Mixed experience (high risk of bias)				
Leung 1992	2/93	3/93		0.67 [0.11, 3.90]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Subtotal (95% CI)	**136**	**153**		**0.51 [0.11, 2.28]**
Total events: 2 (Gamma nail), 5 (SHS)				
Heterogeneity: Chi² = 0.25, df = 1 (P = 0.62); I² =0.0%				
Test for overall effect: Z = 0.89 (P = 0.38)				
Total (95% CI)	**1334**	**1361**		**1.15 [0.76, 1.72]**
Total events: 46 (Gamma nail), 41 (SHS)				
Heterogeneity: Chi² = 8.69, df = 18 (P = 0.97); I² =0.0%				
Test for overall effect: Z = 0.66 (P = 0.51)				

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.10. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 10 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 10 Non-union

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Leung 1992	1/93	0/93		3.00 [0.12, 72.71]
Radford 1993	0/100	0/100		0.0 [0.0, 0.0]
Ahrengart 1994	2/87	2/81		0.93 [0.13, 6.46]
Goldhagen 1994	0/34	0/38		0.0 [0.0, 0.0]
Kukla 1997	0/45	0/44		0.0 [0.0, 0.0]
Park 1998	0/30	1/30		0.33 [0.01, 7.87]
Michos 2001	0/25	0/24		0.0 [0.0, 0.0]
Papasimos 2005	1/40	1/40		1.00 [0.06, 15.44]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Total (95% CI)	**527**	**523**		**0.97 [0.29, 3.31]**
Total events: 4 (Gamma nail), 4 (SHS)				
Heterogeneity: Chi² = 0.92, df = 3 (P = 0.82); I² =0.0%				
Test for overall effect: Z = 0.05 (P = 0.96)				

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.11. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 11 Reoperation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 11 Reoperation

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma 1 nail					
Guyer 1991	5/50	6/50		11.2 %	0.83 [0.27, 2.55]
Leung 1992	4/93	2/93		3.7 %	2.00 [0.38, 10.65]
Radford 1993	6/100	3/100		5.6 %	2.00 [0.51, 7.78]
Mott 1993	3/35	0/34		0.9 %	6.81 [0.36, 127.00]
Benum 1994	16/226	3/234		5.5 %	5.52 [1.63, 18.69]
Goldhagen 1994	3/36	0/39		0.9 %	7.57 [0.40, 141.62]
Ahrengart 1994	6/105	8/104		15.0 %	0.74 [0.27, 2.07]
O'Brien 1995	5/53	2/49		3.9 %	2.31 [0.47, 11.37]
Butt 1995	3/47	0/48		0.9 %	7.15 [0.38, 134.67]
Hoffman 1996	1/31	1/36		1.7 %	1.16 [0.08, 17.80]
Haynes 1996	2/18	0/23		0.8 %	6.32 [0.32, 123.86]
Kukla 1997	1/60	1/60		1.9 %	1.00 [0.06, 15.62]
Michos 2001	1/25	1/24		1.9 %	0.96 [0.06, 14.50]
Adams 2001	12/203	8/197		15.2 %	1.46 [0.61, 3.48]

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Marques Lopez 2002	2/43	4/60		6.3 %	0.70 [0.13, 3.64]
Subtotal (95% CI)	**1125**	**1151**		**75.6 %**	**1.80 [1.24, 2.62]**
Total events: 70 (Gamma nail), 39 (SHS)					
Heterogeneity: Chi^2 = 13.29, df = 14 (P = 0.50); I^2 =0.0%					
Test for overall effect: Z = 3.07 (P = 0.0021)					
2 Trochanteric Gamma nail					
Papasimos 2005	3/40	3/40		5.6 %	1.00 [0.21, 4.66]
Utrilla 2005	1/82	4/81		7.5 %	0.25 [0.03, 2.16]
Ovesen 2006	12/73	6/73		11.2 %	2.00 [0.79, 5.04]
Subtotal (95% CI)	**195**	**194**		**24.4 %**	**1.23 [0.61, 2.47]**
Total events: 16 (Gamma nail), 13 (SHS)					
Heterogeneity: Chi^2 = 3.24, df = 2 (P = 0.20); I^2 =38%					
Test for overall effect: Z = 0.58 (P = 0.56)					
Total (95% CI)	**1320**	**1345**		**100.0 %**	**1.66 [1.19, 2.31]**
Total events: 86 (Gamma nail), 52 (SHS)					
Heterogeneity: Chi^2 = 16.52, df = 17 (P = 0.49); I^2 =0.0%					
Test for overall effect: Z = 3.01 (P = 0.0026)					

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail | Favours SHS

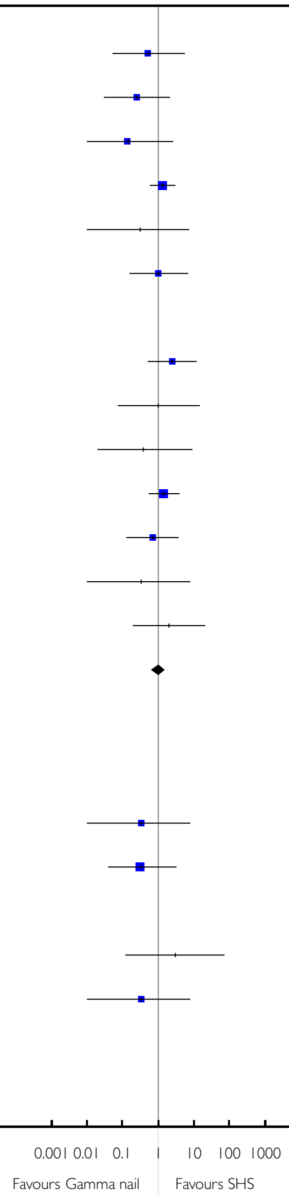
Analysis 2.12. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 12 Wound infection or haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 12 Wound infection or haematoma

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Wound infection - any type			
Bridle 1991	1/49	2/51	0.52 [0.05, 5.56]
Radford 1993	1/100	4/100	0.25 [0.03, 2.20]
Mott 1993	0/35	3/34	0.14 [0.01, 2.59]
Ahrengart 1994	12/105	9/104	1.32 [0.58, 3.00]
O'Brien 1995	0/53	1/49	0.31 [0.01, 7.40]
Butt 1995	2/47	2/48	1.02 [0.15, 6.95]
Hoffman 1996	0/31	0/36	0.0 [0.0, 0.0]
Kukla 1997	5/60	2/60	2.50 [0.50, 12.39]
Park 1998	1/30	1/30	1.00 [0.07, 15.26]
Kuwabara 1998	0/20	1/23	0.38 [0.02, 8.86]
Adams 2001	9/203	6/197	1.46 [0.53, 4.01]
Marques Lopez 2002	2/43	4/60	0.70 [0.13, 3.64]
Papasimos 2005	0/40	1/40	0.33 [0.01, 7.95]
Ovesen 2006	2/73	1/73	2.00 [0.19, 21.58]
Subtotal (95% CI)	**889**	**905**	**0.97 [0.62, 1.50]**
Total events: 35 (Gamma nail), 37 (SHS)			
Heterogeneity: Chi^2 = 7.75, df = 12 (P = 0.80); I^2 =0.0%			
Test for overall effect: Z = 0.15 (P = 0.88)			
2 Deep wound infection			
Guyer 1991	0/50	1/50	0.33 [0.01, 7.99]
Leung 1992	1/93	3/93	0.33 [0.04, 3.15]
Mott 1993	0/35	0/34	0.0 [0.0, 0.0]
Radford 1993	1/100	0/100	3.00 [0.12, 72.77]
Ahrengart 1994	0/105	1/104	0.33 [0.01, 8.01]
O'Brien 1995	0/53	0/49	0.0 [0.0, 0.0]
Hoffman 1996	0/31	0/36	0.0 [0.0, 0.0]



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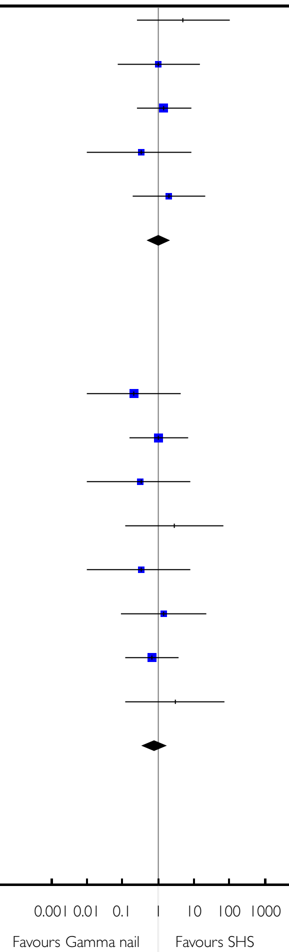
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Kukla 1997	2/60	0/60		5.00 [0.25, 102.00]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Adams 2001	3/203	2/197		1.46 [0.25, 8.62]
Utrilla 2005	0/104	1/106		0.34 [0.01, 8.24]
Ovesen 2006	2/73	1/73		2.00 [0.19, 21.58]
Subtotal (95% CI)	**937**	**932**		**0.99 [0.46, 2.17]**
Total events: 10 (Gamma nail), 10 (SHS)				
Heterogeneity: $Chi^2 = 4.33$, df = 8 (P = 0.83); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.01 (P = 0.99)				
3 Wound haematoma				
Bridle 1991	0/49	2/51		0.21 [0.01, 4.23]
Guyer 1991	2/50	2/50		1.00 [0.15, 6.82]
Mott 1993	0/35	1/34		0.32 [0.01, 7.69]
O'Brien 1995	1/52	0/49		2.83 [0.12, 67.87]
Kukla 1997	0/60	1/60		0.33 [0.01, 8.02]
Marques Lopez 2002	1/43	1/60		1.40 [0.09, 21.70]
Papasimos 2005	2/40	3/40		0.67 [0.12, 3.78]
Ovesen 2006	1/73	0/73		3.00 [0.12, 72.45]
Subtotal (95% CI)	**402**	**417**		**0.78 [0.34, 1.79]**
Total events: 7 (Gamma nail), 10 (SHS)				
Heterogeneity: $Chi^2 = 2.90$, df = 7 (P = 0.89); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.58 (P = 0.56)				



Analysis 2.13. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 13 Pneumonia.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

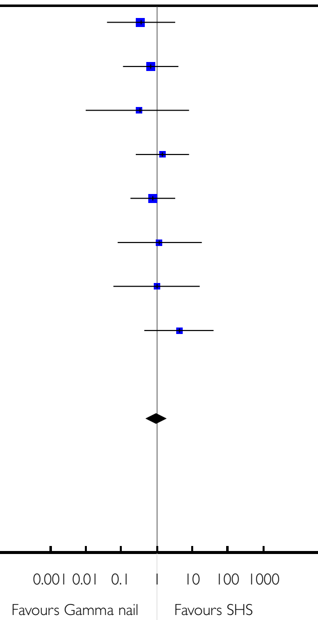
Outcome: 13 Pneumonia

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Bridle 1991	1/49	3/51		0.35 [0.04, 3.22]
Leung 1992	2/93	3/93		0.67 [0.11, 3.90]
Mott 1993	0/35	1/34		0.32 [0.01, 7.69]
O'Brien 1995	3/52	2/49		1.41 [0.25, 8.10]
Butt 1995	3/47	4/48		0.77 [0.18, 3.24]
Hoffman 1996	1/31	1/36		1.16 [0.08, 17.80]
Kukla 1997	1/60	1/60		1.00 [0.06, 15.62]
Marques Lopez 2002	3/43	1/60		4.19 [0.45, 38.89]
Papasimos 2005	0/40	0/40		0.0 [0.0, 0.0]
Total (95% CI)	**450**	**471**		**0.93 [0.47, 1.83]**

Total events: 14 (Gamma nail), 16 (SHS)

Heterogeneity: Chi^2 = 3.38, df = 7 (P = 0.85); I^2 =0.0%

Test for overall effect: Z = 0.22 (P = 0.82)



Analysis 2.14. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 14 Pressure sore.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

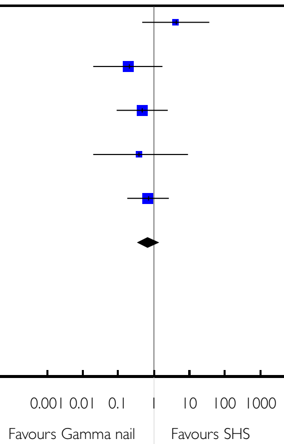
Outcome: 14 Pressure sore

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Fixed,95% CI
Bridle 1991	4/49	1/51	6.0 %	4.16 [0.48, 35.95]
Butt 1995	1/47	5/48	30.1 %	0.20 [0.02, 1.68]
O'Brien 1995	2/52	4/49	25.0 %	0.47 [0.09, 2.46]
Hoffman 1996	0/31	1/36	8.5 %	0.39 [0.02, 9.13]
Marques Lopez 2002	3/43	6/60	30.5 %	0.70 [0.18, 2.64]
Total (95% CI)	**222**	**244**	**100.0 %**	**0.67 [0.32, 1.42]**

Total events: 10 (Gamma nail), 17 (SHS)

Heterogeneity: $Chi^2 = 4.27$, df = 4 (P = 0.37); $I^2 = 6\%$

Test for overall effect: Z = 1.04 (P = 0.30)



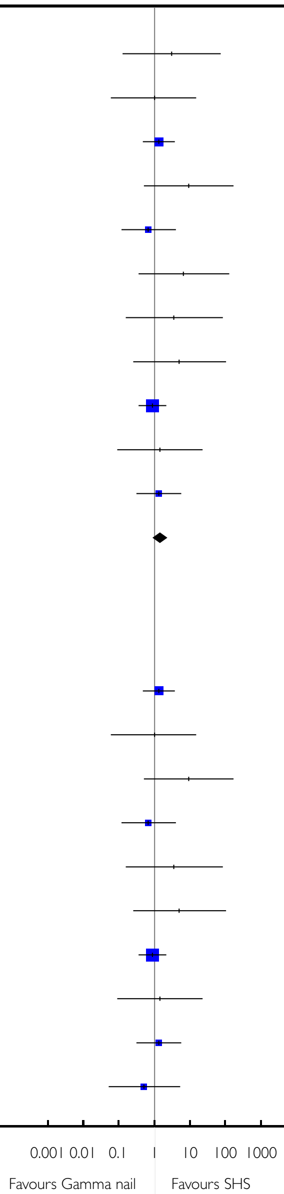
Analysis 2.15. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 15 Thromboembolic complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 15 Thromboembolic complications

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Thromboembolic complication				
Bridle 1991	1/49	0/51		3.12 [0.13, 74.80]
Mott 1993	1/35	1/34		0.97 [0.06, 14.91]
Radford 1993	8/100	6/100		1.33 [0.48, 3.70]
Ahrengart 1994	4/105	0/104		8.92 [0.49, 163.53]
Butt 1995	2/47	3/48		0.68 [0.12, 3.89]
O'Brien 1995	3/52	0/49		6.60 [0.35, 124.65]
Hoffman 1996	1/31	0/36		3.47 [0.15, 82.21]
Kukla 1997	2/60	0/60		5.00 [0.25, 102.00]
Adams 2001	9/203	10/197		0.87 [0.36, 2.10]
Marques Lopez 2002	1/43	1/60		1.40 [0.09, 21.70]
Utrilla 2005	4/82	3/81		1.32 [0.30, 5.70]
Subtotal (95% CI)	**807**	**820**		**1.46 [0.90, 2.36]**
Total events: 36 (Gamma nail), 24 (SHS)				
Heterogeneity: Chi^2 = 5.82, df = 10 (P = 0.83); I^2 =0.0%				
Test for overall effect: Z = 1.52 (P = 0.13)				
2 Deep vein thrombosis				
Radford 1993	8/100	6/100		1.33 [0.48, 3.70]
Mott 1993	1/35	1/34		0.97 [0.06, 14.91]
Ahrengart 1994	4/105	0/104		8.92 [0.49, 163.53]
Butt 1995	2/47	3/48		0.68 [0.12, 3.89]
Hoffman 1996	1/31	0/36		3.47 [0.15, 82.21]
Kukla 1997	2/60	0/60		5.00 [0.25, 102.00]
Adams 2001	9/203	10/197		0.87 [0.36, 2.10]
Marques Lopez 2002	1/43	1/60		1.40 [0.09, 21.70]
Utrilla 2005	4/82	3/81		1.32 [0.30, 5.70]
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]



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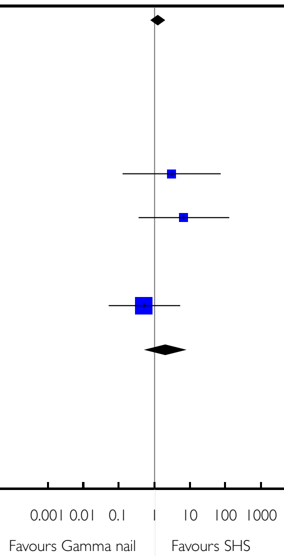
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**746**	**760**		**1.26 [0.77, 2.06]**
Total events: 33 (Gamma nail), 26 (SHS)				
Heterogeneity: Chi^2 = 4.73, df = 9 (P = 0.86); I^2 =0.0%				
Test for overall effect: Z = 0.93 (P = 0.35)				
3 Pulmonary embolism				
Bridle 1991	1/49	0/51		3.12 [0.13, 74.80]
O'Brien 1995	3/52	0/49		6.60 [0.35, 124.65]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Subtotal (95% CI)	**201**	**200**		**1.97 [0.50, 7.82]**
Total events: 5 (Gamma nail), 2 (SHS)				
Heterogeneity: Chi^2 = 2.03, df = 2 (P = 0.36); I^2 =1%				
Test for overall effect: Z = 0.97 (P = 0.33)				



Analysis 2.16. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 16 Any medical complication (other than wound infection or haematoma).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

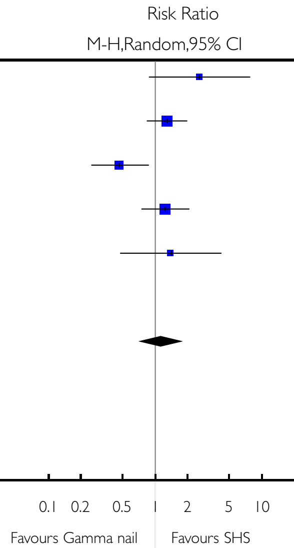
Outcome: 16 Any medical complication (other than wound infection or haematoma)

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Random,95% CI
Bridle 1991	10/49	4/51	2.60 [0.87, 7.75]
O'Brien 1995	26/52	19/49	1.29 [0.83, 2.01]
Butt 1995	10/47	22/48	0.46 [0.25, 0.87]
Hoffman 1996	16/31	15/36	1.24 [0.74, 2.07]
Kukla 1997	7/60	5/60	1.40 [0.47, 4.17]
Ovesen 2006	0/73	0/73	0.0 [0.0, 0.0]
Total (95% CI)	**312**	**317**	**1.13 [0.69, 1.84]**

Total events: 69 (Gamma nail), 65 (SHS)

Heterogeneity: $Tau^2 = 0.18$; $Chi^2 = 10.48$, df = 4 (P = 0.03); $I^2 = 62\%$

Test for overall effect: Z = 0.47 (P = 0.64)



Analysis 2.17. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 17 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

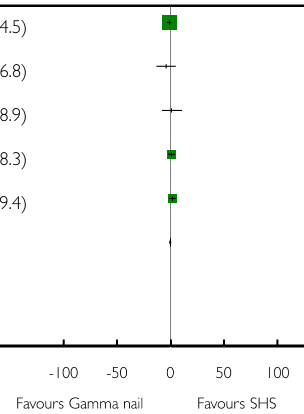
Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 17 Length of hospital stay (days)

Study or subgroup	Gamma nail N	Gamma nail Mean(SD)	SHS N	SHS Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Leung 1992	93	26.9 (8.2)	93	28.3 (4.5)		52.2 %	-1.40 [-3.30, 0.50]
O'Brien 1995	52	23.7 (19)	49	27.6 (26.8)		2.3 %	-3.90 [-13.01, 5.21]
Hoffman 1996	31	29.8 (20.1)	36	28.5 (18.9)		2.1 %	1.30 [-8.09, 10.69]
Kukla 1997	60	15.1 (8.5)	60	14.1 (8.3)		20.9 %	1.00 [-2.01, 4.01]
Ovesen 2006	73	16.4 (8.4)	73	14.4 (9.4)		22.5 %	2.00 [-0.89, 4.89]
Total (95% CI)	**309**		**311**			**100.0 %**	**-0.13 [-1.50, 1.24]**

Heterogeneity: Chi² = 5.09, df = 4 (P = 0.28); I² =21%

Test for overall effect: Z = 0.19 (P = 0.85)



Analysis 2.18. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 18 Anatomical deformity.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 18 Anatomical deformity

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Shortening of leg					
Guyer 1991	4/28	12/32		66.9 %	0.38 [0.14, 1.05]
Leung 1992	3/93	2/93		11.9 %	1.50 [0.26, 8.77]
Kukla 1997	0/45	3/44		21.1 %	0.14 [0.01, 2.63]
Subtotal (95% CI)	**166**	**169**		**100.0 %**	**0.46 [0.21, 1.03]**
Total events: 7 (Gamma nail), 17 (SHS)					
Heterogeneity: $Chi^2 = 2.48$, df = 2 (P = 0.29); I^2 =19%					
Test for overall effect: Z = 1.89 (P = 0.059)					
2 Varus deformity					
Leung 1992	2/93	2/93		10.8 %	1.00 [0.14, 6.95]
Ahrengart 1994	6/87	8/81		44.8 %	0.70 [0.25, 1.93]
O'Brien 1995	3/53	5/49		28.1 %	0.55 [0.14, 2.20]
Park 1998	1/30	2/30		10.8 %	0.50 [0.05, 5.22]
Utrilla 2005	1/82	1/81		5.4 %	0.99 [0.06, 15.53]
Subtotal (95% CI)	**345**	**334**		**100.0 %**	**0.68 [0.34, 1.37]**
Total events: 13 (Gamma nail), 18 (SHS)					
Heterogeneity: $Chi^2 = 0.37$, df = 4 (P = 0.98); I^2 =0.0%					
Test for overall effect: Z = 1.08 (P = 0.28)					
3 External rotational deformity					
Leung 1992	2/93	1/93		26.4 %	2.00 [0.18, 21.68]
Kuwabara 1998	2/20	3/23		73.6 %	0.77 [0.14, 4.14]
Subtotal (95% CI)	**113**	**116**		**100.0 %**	**1.09 [0.28, 4.19]**
Total events: 4 (Gamma nail), 4 (SHS)					
Heterogeneity: $Chi^2 = 0.42$, df = 1 (P = 0.52); I^2 =0.0%					
Test for overall effect: Z = 0.13 (P = 0.90)					

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.19. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 19 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

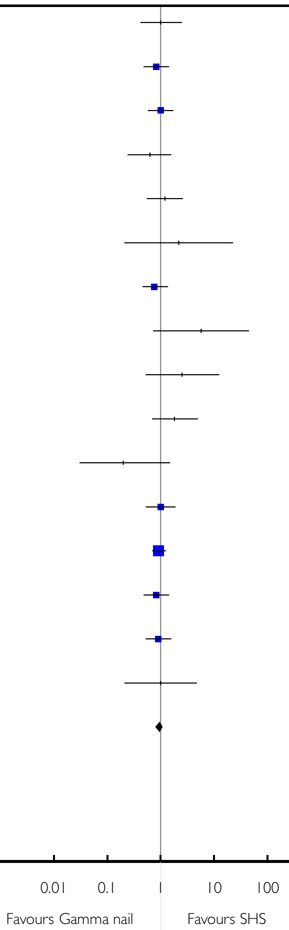
Outcome: 19 Mortality

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Guyer 1991	8/50	8/50		3.6 %	1.00 [0.41, 2.46]
Bridle 1991	15/49	19/51		8.4 %	0.82 [0.47, 1.43]
Leung 1992	20/113	20/113		9.0 %	1.00 [0.57, 1.75]
Pahlpatz 1993	6/51	10/53		4.4 %	0.62 [0.24, 1.59]
Radford 1993	12/100	10/100		4.5 %	1.20 [0.54, 2.65]
Goldhagen 1994	2/36	1/39		0.4 %	2.17 [0.21, 22.89]
Ahrengart 1994	18/105	23/104		10.4 %	0.78 [0.45, 1.35]
O'Brien 1995	6/52	1/49		0.5 %	5.65 [0.71, 45.29]
Butt 1995	5/47	2/48		0.9 %	2.55 [0.52, 12.52]
Hoffman 1996	8/31	5/36		2.1 %	1.86 [0.68, 5.10]
Haynes 1996	1/19	8/31		2.7 %	0.20 [0.03, 1.51]
Kukla 1997	14/60	14/60		6.3 %	1.00 [0.52, 1.91]
Adams 2001	59/203	61/197		27.9 %	0.94 [0.70, 1.27]
Marques Lopez 2002	13/43	22/60		8.3 %	0.82 [0.47, 1.45]
Utrilla 2005	19/104	21/106		9.4 %	0.92 [0.53, 1.61]
Ovesen 2006	3/73	3/73		1.3 %	1.00 [0.21, 4.79]
Total (95% CI)	**1136**	**1170**		**100.0 %**	**0.95 [0.81, 1.12]**

Total events: 209 (Gamma nail), 228 (SHS)

Heterogeneity: Chi^2 = 10.99, df = 15 (P = 0.75); I^2 =0.0%

Test for overall effect: Z = 0.59 (P = 0.56)



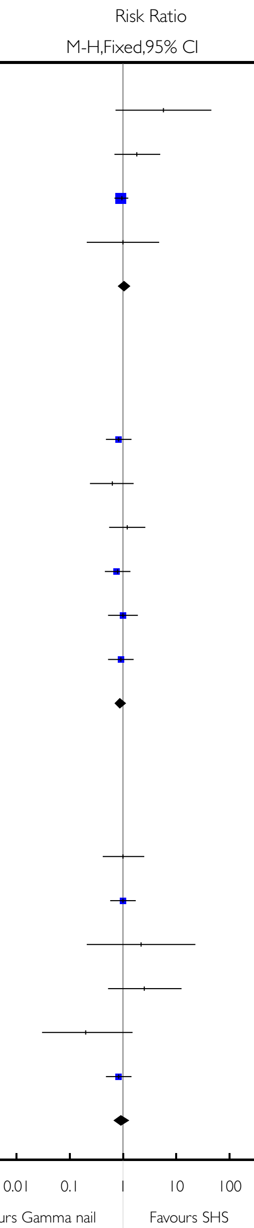
Analysis 2.20. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 20 Mortality (grouped by allocation concealment).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 20 Mortality (grouped by allocation concealment)

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Allocation concealment: fully concealed				
O'Brien 1995	6/52	1/49	0.5 %	5.65 [0.71, 45.29]
Hoffman 1996	8/31	5/36	2.1 %	1.86 [0.68, 5.10]
Adams 2001	59/203	61/197	27.9 %	0.94 [0.70, 1.27]
Ovesen 2006	3/73	3/73	1.3 %	1.00 [0.21, 4.79]
Subtotal (95% CI)	**359**	**355**	**31.7 %**	**1.07 [0.81, 1.41]**
Total events: 76 (Gamma nail), 70 (SHS)				
Heterogeneity: $Chi^2 = 4.35$, df = 3 (P = 0.23); $I^2 = 31\%$				
Test for overall effect: Z = 0.48 (P = 0.63)				
2 Allocation concealment: unclear				
Bridle 1991	15/49	19/51	8.4 %	0.82 [0.47, 1.43]
Pahlpatz 1993	6/51	10/53	4.4 %	0.62 [0.24, 1.59]
Radford 1993	12/100	10/100	4.5 %	1.20 [0.54, 2.65]
Ahrengart 1994	18/105	23/104	10.4 %	0.78 [0.45, 1.35]
Kukla 1997	14/60	14/60	6.3 %	1.00 [0.52, 1.91]
Utrilla 2005	19/104	21/106	9.4 %	0.92 [0.53, 1.61]
Subtotal (95% CI)	**469**	**474**	**43.3 %**	**0.88 [0.68, 1.14]**
Total events: 84 (Gamma nail), 97 (SHS)				
Heterogeneity: $Chi^2 = 1.54$, df = 5 (P = 0.91); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.99 (P = 0.32)				
3 Allocation concealment: not concealed				
Guyer 1991	8/50	8/50	3.6 %	1.00 [0.41, 2.46]
Leung 1992	20/113	20/113	9.0 %	1.00 [0.57, 1.75]
Goldhagen 1994	2/36	1/39	0.4 %	2.17 [0.21, 22.89]
Butt 1995	5/47	2/48	0.9 %	2.55 [0.52, 12.52]
Haynes 1996	1/19	8/31	2.7 %	0.20 [0.03, 1.51]
Marques Lopez 2002	13/43	22/60	8.3 %	0.82 [0.47, 1.45]
Subtotal (95% CI)	**308**	**341**	**24.9 %**	**0.93 [0.66, 1.31]**



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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 49 (Gamma nail), 61 (SHS)					
Heterogeneity: Chi^2 = 4.52, df = 5 (P = 0.48); I^2 =0.0%					
Test for overall effect: Z = 0.42 (P = 0.68)					
Total (95% CI)	**1136**	**1170**		**100.0 %**	**0.95 [0.81, 1.12]**
Total events: 209 (Gamma nail), 228 (SHS)					
Heterogeneity: Chi^2 = 10.99, df = 15 (P = 0.75); I^2 =0.0%					
Test for overall effect: Z = 0.59 (P = 0.56)					

0.01 0.1 1 10 100

Favours Gamma nail Favours SHS

Analysis 2.21. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 21 Pain at follow-up.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 21 Pain at follow-up

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Guyer 1991	19/28	18/32		14.3 %	1.21 [0.81, 1.80]
Leung 1992	22/93	32/93		27.3 %	0.69 [0.43, 1.09]
Ahrengart 1994	25/88	15/83		13.2 %	1.57 [0.89, 2.77]
Hoffman 1996	9/23	9/31		6.5 %	1.35 [0.64, 2.85]
Utrilla 2005	50/82	45/81		38.6 %	1.10 [0.85, 1.42]
Total (95% CI)	**314**	**320**		**100.0 %**	**1.08 [0.90, 1.30]**
Total events: 125 (Gamma nail), 119 (SHS)					
Heterogeneity: Chi^2 = 6.03, df = 4 (P = 0.20); I^2 =34%					
Test for overall effect: Z = 0.81 (P = 0.42)					

0.1 0.2 0.5 1 2 5 10

Favours Gamma nail Favours SHS

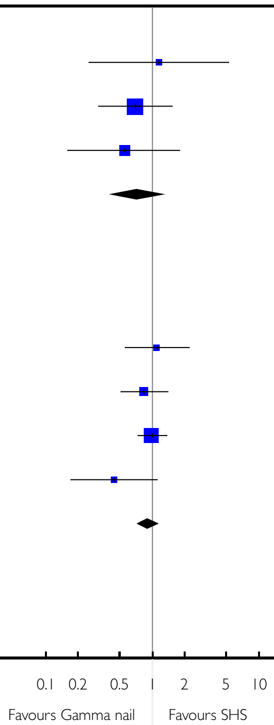
Analysis 2.22. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 22 Non-return to previous residence.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 22 Non-return to previous residence

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Non-return to previous residence (survivors)					
Guyer 1991	3/28	3/32		13.9 %	1.14 [0.25, 5.21]
Pahlpatz 1993	8/45	11/43		55.7 %	0.69 [0.31, 1.56]
Haynes 1996	3/18	7/23		30.4 %	0.55 [0.16, 1.82]
Subtotal (95% CI)	**91**	**98**		**100.0 %**	**0.71 [0.39, 1.31]**
Total events: 14 (Gamma nail), 21 (SHS)					
Heterogeneity: $Chi^2 = 0.56$, df = 2 (P = 0.76); $I^2 = 0.0\%$					
Test for overall effect: Z = 1.09 (P = 0.28)					
2 Non-return to previous residence or dead					
Guyer 1991	11/36	11/40		12.2 %	1.11 [0.55, 2.25]
Pahlpatz 1993	17/51	21/53		24.1 %	0.84 [0.50, 1.40]
Ahrengart 1994	43/105	43/104		50.5 %	0.99 [0.72, 1.37]
Haynes 1996	4/19	15/31		13.3 %	0.44 [0.17, 1.12]
Subtotal (95% CI)	**211**	**228**		**100.0 %**	**0.90 [0.70, 1.15]**
Total events: 75 (Gamma nail), 90 (SHS)					
Heterogeneity: $Chi^2 = 3.04$, df = 3 (P = 0.39); $I^2 = 1\%$					
Test for overall effect: Z = 0.88 (P = 0.38)					



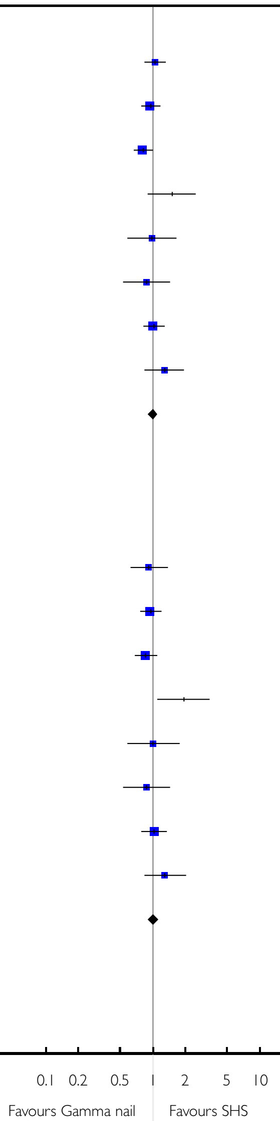
Analysis 2.23. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 23 Impaired walking.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 23 Impaired walking

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Impaired walking					
Guyer 1991	24/28	26/32		8.6 %	1.05 [0.84, 1.32]
Leung 1992	59/93	62/93		21.9 %	0.95 [0.77, 1.17]
Ahrengart 1994	53/87	61/81		22.3 %	0.81 [0.66, 1.00]
Haynes 1996	13/18	11/23		3.4 %	1.51 [0.90, 2.53]
Kukla 1997	17/45	17/44		6.1 %	0.98 [0.58, 1.66]
Park 1998	14/30	16/30		5.7 %	0.88 [0.53, 1.45]
Adams 2001	70/126	66/121		23.8 %	1.02 [0.81, 1.28]
Ovesen 2006	30/67	23/66		8.2 %	1.28 [0.84, 1.96]
Subtotal (95% CI)	**494**	**490**		**100.0 %**	**0.99 [0.89, 1.10]**
Total events: 280 (Gamma nail), 282 (SHS)					
Heterogeneity: Chi^2 = 8.33, df = 7 (P = 0.30); I^2 =16%					
Test for overall effect: Z = 0.22 (P = 0.82)					
2 Impaired walking (overall denominators used)					
Guyer 1991	24/50	26/50		9.3 %	0.92 [0.62, 1.37]
Leung 1992	59/113	62/113		22.1 %	0.95 [0.75, 1.21]
Ahrengart 1994	53/105	61/104		21.8 %	0.86 [0.67, 1.10]
Haynes 1996	13/19	11/31		3.0 %	1.93 [1.10, 3.39]
Kukla 1997	17/60	17/60		6.1 %	1.00 [0.57, 1.77]
Park 1998	14/30	16/30		5.7 %	0.88 [0.53, 1.45]
Adams 2001	70/203	66/197		23.9 %	1.03 [0.78, 1.35]
Ovesen 2006	30/73	23/73		8.2 %	1.30 [0.84, 2.02]
Subtotal (95% CI)	**653**	**658**		**100.0 %**	**1.00 [0.89, 1.13]**
Total events: 280 (Gamma nail), 282 (SHS)					
Heterogeneity: Chi^2 = 8.67, df = 7 (P = 0.28); I^2 =19%					
Test for overall effect: Z = 0.07 (P = 0.95)					



Analysis 3.1. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

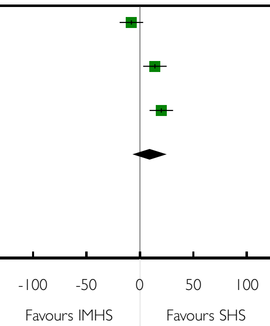
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	IMHS		SHS		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Baumgaertner 1998	67	72 (33)	68	80 (35)		32.8 %	-8.00 [-19.47, 3.47]
Hardy 1998	50	71 (28.9)	50	57 (24.8)		33.6 %	14.00 [3.44, 24.56]
Harrington 2002	50	108 (26.8)	52	88 (27.5)		33.6 %	20.00 [9.46, 30.54]
Total (95% CI)	**167**		**170**			**100.0 %**	**8.81 [-7.43, 25.05]**

Heterogeneity: $Tau^2 = 175.30$; $Chi^2 = 13.45$, df = 2 (P = 0.001); $I^2 = 85\%$

Test for overall effect: Z = 1.06 (P = 0.29)



Analysis 3.2. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 2 Blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

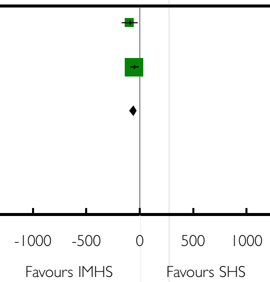
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 2 Blood loss (ml)

Study or subgroup	IMHS		SHS		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI		IV,Fixed,95% CI
Baumgaertner 1998	67	245 (145)	68	340 (302)		20.5 %	-95.00 [-174.74, -15.26]
Hardy 1998	50	144 (120.5)	50	198 (82.9)		79.5 %	-54.00 [-94.54, -13.46]
Total (95% CI)	**117**		**118**			**100.0 %**	**-62.42 [-98.56, -26.28]**

Heterogeneity: $Chi^2 = 0.81$, df = 1 (P = 0.37); $I^2 = 0.0\%$

Test for overall effect: Z = 3.39 (P = 0.00071)



Analysis 3.3. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 3 Transfusion (units of red cells).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

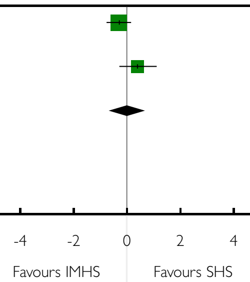
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 3 Transfusion (units of red cells)

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Hardy 1998	50	0.9 (0.96)	50	1.2 (1.29)		57.8 %	-0.30 [-0.75, 0.15]
Baumgaertner 1998	67	2.2 (2.4)	68	1.8 (1.7)		42.2 %	0.40 [-0.30, 1.10]
Total (95% CI)	**117**		**118**			**100.0 %**	**0.00 [-0.68, 0.67]**

Heterogeneity: Tau^2 = 0.15; Chi^2 = 2.72, df = 1 (P = 0.10); I^2 =63%

Test for overall effect: Z = 0.01 (P = 0.99)



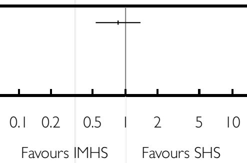
Analysis 3.4. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 4 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 4 Number of patients transfused

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Harrington 2002	18/50	22/52		0.85 [0.52, 1.39]



Analysis 3.5. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 5 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

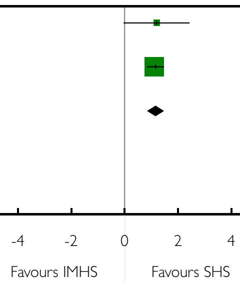
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 5 Radiographic screening time (minutes)

Study or subgroup	IMHS N	IMHS Mean(SD)	SHS N	SHS Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Baumgaertner 1998	67	4 (3.2)	68	2.8 (4.1)		6.6 %	1.20 [-0.04, 2.44]
Harrington 2002	50	2.27 (0.89)	52	1.12 (0.81)		93.4 %	1.15 [0.82, 1.48]
Total (95% CI)	**117**		**120**			**100.0 %**	**1.15 [0.83, 1.47]**

Heterogeneity: Chi^2 = 0.01, df = 1 (P = 0.94); I^2 =0.0%

Test for overall effect: Z = 7.08 (P < 0.00001)



Analysis 3.6. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 6 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

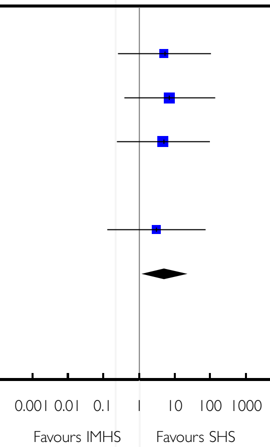
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 6 Fracture fixation complications

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Operative fracture of femur				
Baumgaertner 1998	2/67	0/68		5.07 [0.25, 103.74]
Hardy 1998	3/50	0/50		7.00 [0.37, 132.10]
Hoffmann 1999	2/56	0/54		4.82 [0.24, 98.24]
Mehdi 2000	0/90	0/90		0.0 [0.0, 0.0]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**313**	**314**		**5.01 [1.11, 22.65]**

Total events: 8 (IMHS), 0 (SHS)

Heterogeneity: Chi^2 = 0.14, df = 3 (P = 0.99); I^2 =0.0%



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Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 2.09 (P = 0.036)				
2 Later fracture of femur				
Baumgaertner 1998	3/67	0/68		7.10 [0.37, 134.92]
Hardy 1998	0/50	0/50		0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**223**	**224**		**5.12 [0.61, 43.33]**
Total events: 4 (IMHS), 0 (SHS)				
Heterogeneity: $Chi^2 = 0.14$, df = 1 (P = 0.71); $I^2 = 0.0\%$				
Test for overall effect: Z = 1.50 (P = 0.13)				
3 Cut-out				
Baumgaertner 1998	2/67	2/68		1.01 [0.15, 7.00]
Hardy 1998	0/50	1/50		0.33 [0.01, 7.99]
Mehdi 2000	1/90	1/90		1.00 [0.06, 15.74]
Harrington 2002	1/50	1/52		1.04 [0.07, 16.18]
Subtotal (95% CI)	**257**	**260**		**0.83 [0.24, 2.84]**
Total events: 4 (IMHS), 5 (SHS)				
Heterogeneity: $Chi^2 = 0.40$, df = 3 (P = 0.94); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.30 (P = 0.77)				
4 Non-union				
Baumgaertner 1998	1/67	1/68		1.01 [0.06, 15.90]
Hardy 1998	0/35	1/35		0.33 [0.01, 7.91]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**152**	**155**		**1.02 [0.21, 4.95]**
Total events: 2 (IMHS), 2 (SHS)				
Heterogeneity: $Chi^2 = 0.95$, df = 2 (P = 0.62); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.02 (P = 0.98)				
5 Detachment of the plate from the femur				
Harrington 2002	0/50	1/52		0.35 [0.01, 8.31]
Subtotal (95% CI)	**50**	**52**		**0.35 [0.01, 8.31]**
Total events: 0 (IMHS), 1 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.65 (P = 0.51)				
6 Reoperation				
Hardy 1998	3/50	4/50		0.75 [0.18, 3.18]
Hoffmann 1999	0/56	2/54		0.19 [0.01, 3.93]
Subtotal (95% CI)	**106**	**104**		**0.53 [0.15, 1.88]**
Total events: 3 (IMHS), 6 (SHS)				
Heterogeneity: $Chi^2 = 0.65$, df = 1 (P = 0.42); $I^2 = 0.0\%$				

0.001 0.01 0.1 1 10 100 1000

Favours IMHS Favours SHS

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Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.98 (P = 0.33)				

0.001 0.01 0.1 1 10 100 1000

Favours IMHS Favours SHS

Analysis 3.7. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 7 Wound infection or haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 7 Wound infection or haematoma

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Wound infection - any type				
Hardy 1998	0/50	0/50		0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Mehdi 2000	2/90	5/90		0.40 [0.08, 2.01]
Subtotal (95% CI)	**196**	**194**		**0.40 [0.08, 2.01]**
Total events: 2 (IMHS), 5 (SHS)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 1.11 (P = 0.27)				
2 Deep wound infection				
Hardy 1998	0/50	0/50		0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Mehdi 2000	0/90	1/90		0.33 [0.01, 8.08]
Subtotal (95% CI)	**196**	**194**		**0.33 [0.01, 8.08]**
Total events: 0 (IMHS), 1 (SHS)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.68 (P = 0.50)				
3 Wound haematoma				
Baumgaertner 1998	1/67	0/68		3.04 [0.13, 73.42]
Hardy 1998	4/50	0/50		9.00 [0.50, 162.89]
Hoffmann 1999	3/56	5/54		0.58 [0.15, 2.30]

0.001 0.01 0.1 1 10 100 1000

Favours IMHS Favours SHS

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Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**173**	**172**		**1.47 [0.54, 4.02]**
Total events: 8 (IMHS), 5 (SHS)				
Heterogeneity: Chi² = 3.46, df = 2 (P = 0.18); I² =42%				
Test for overall effect: Z = 0.75 (P = 0.45)				

0.001 0.01 0.1 1 10 100 1000

Favours IMHS Favours SHS

Analysis 3.8. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 8 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 8 Post-operative complications

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia					
Hardy 1998	4/50	6/50		92.2 %	0.67 [0.20, 2.22]
Hoffmann 1999	2/56	0/54		7.8 %	4.82 [0.24, 98.24]
Subtotal (95% CI)	**106**	**104**		**100.0 %**	**0.99 [0.35, 2.83]**
Total events: 6 (IMHS), 6 (SHS)					
Heterogeneity: Chi² = 1.48, df = 1 (P = 0.22); I² =32%					
Test for overall effect: Z = 0.02 (P = 0.99)					
2 Thromboembolic complication					
Hardy 1998	1/50	2/50		100.0 %	0.50 [0.05, 5.34]
Subtotal (95% CI)	**50**	**50**		**100.0 %**	**0.50 [0.05, 5.34]**
Total events: 1 (IMHS), 2 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.57 (P = 0.57)					
3 Deep vein thrombosis					
Hardy 1998	1/50	2/50		79.7 %	0.50 [0.05, 5.34]
Hoffmann 1999	1/56	0/54		20.3 %	2.89 [0.12, 69.55]
Subtotal (95% CI)	**106**	**104**		**100.0 %**	**0.99 [0.17, 5.62]**
Total events: 2 (IMHS), 2 (SHS)					

0.001 0.01 0.1 1 10 100 1000

Favours IMHS Favours SHS

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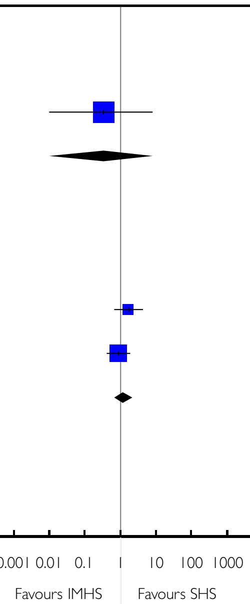
Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Heterogeneity: Chi^2 = 0.76, df = 1 (P = 0.38); I^2 =0.0%					
Test for overall effect: Z = 0.02 (P = 0.99)					
4 Pulmonary embolism					
Hardy 1998	0/50	1/50		100.0 %	0.33 [0.01, 7.99]
Subtotal (95% CI)	**50**	**50**		**100.0 %**	**0.33 [0.01, 7.99]**
Total events: 0 (IMHS), 1 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.68 (P = 0.50)					
5 Major medical complication					
Baumgaertner 1998	10/67	6/68		34.7 %	1.69 [0.65, 4.39]
Hoffmann 1999	10/56	11/54		65.3 %	0.88 [0.41, 1.89]
Subtotal (95% CI)	**123**	**122**		**100.0 %**	**1.16 [0.64, 2.10]**
Total events: 20 (IMHS), 17 (SHS)					
Heterogeneity: Chi^2 = 1.11, df = 1 (P = 0.29); I^2 =10%					
Test for overall effect: Z = 0.49 (P = 0.62)					



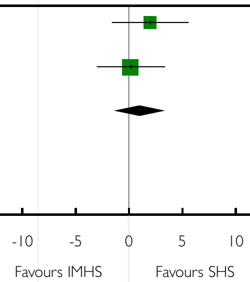
Analysis 3.9. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 9 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 9 Length of hospital stay (days)

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Baumgaertner 1998	67	13 (14)	68	11 (5)		44.4 %	2.00 [-1.56, 5.56]
Harrington 2002	50	16.5 (8.8)	52	16.3 (7.5)		55.6 %	0.20 [-2.98, 3.38]
Total (95% CI)	**117**		**120**			**100.0 %**	**1.00 [-1.37, 3.37]**
Heterogeneity: Chi^2 = 0.55, df = 1 (P = 0.46); I^2 =0.0%							
Test for overall effect: Z = 0.83 (P = 0.41)							



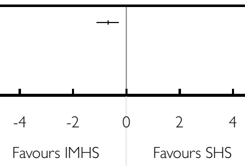
Analysis 3.10. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 10 Mean limb shortening (cm).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 10 Mean limb shortening (cm)

Study or subgroup	IMHS N	IMHS Mean(SD)	SHS N	SHS Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Hardy 1998	27	0.6 (0.69)	37	1.3 (1.08)		-0.70 [-1.13, -0.27]



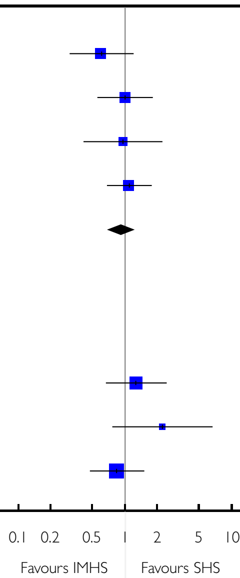
Analysis 3.11. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 11 Final outcome measures.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 11 Final outcome measures

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Mortality					
Baumgaertner 1998	10/65	17/66		28.3 %	0.60 [0.30, 1.21]
Hardy 1998	15/50	15/50		25.1 %	1.00 [0.55, 1.82]
Hoffmann 1999	9/56	9/54		15.4 %	0.96 [0.41, 2.24]
Harrington 2002	20/50	19/52		31.2 %	1.09 [0.67, 1.79]
Subtotal (95% CI)	**221**	**222**		**100.0 %**	**0.91 [0.67, 1.24]**
Total events: 54 (IMHS), 60 (SHS)					
Heterogeneity: Chi^2 = 2.03, df = 3 (P = 0.57); I^2 =0.0%					
Test for overall effect: Z = 0.59 (P = 0.55)					
2 Pain					
Baumgaertner 1998	15/52	12/53		36.9 %	1.27 [0.66, 2.45]
Hardy 1998	9/35	4/35		12.4 %	2.25 [0.76, 6.63]
Hoffmann 1999	14/45	16/43		50.7 %	0.84 [0.47, 1.50]



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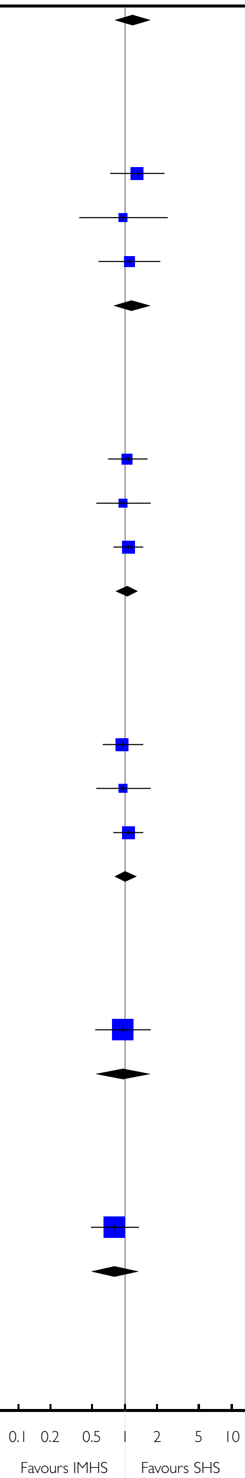
Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**132**	**131**		**100.0 %**	**1.17 [0.79, 1.75]**
Total events: 38 (IMHS), 32 (SHS)					
Heterogeneity: Chi² = 2.75, df = 2 (P = 0.25); I² =27%					
Test for overall effect: Z = 0.78 (P = 0.43)					
3 Failure to return home (survivors)					
Baumgaertner 1998	18/52	14/53		44.0 %	1.31 [0.73, 2.35]
Hoffmann 1999	7/45	7/43		22.7 %	0.96 [0.37, 2.50]
Harrington 2002	11/30	11/33		33.3 %	1.10 [0.56, 2.16]
Subtotal (95% CI)	**127**	**129**		**100.0 %**	**1.16 [0.78, 1.73]**
Total events: 36 (IMHS), 32 (SHS)					
Heterogeneity: Chi² = 0.35, df = 2 (P = 0.84); I² =0.0%					
Test for overall effect: Z = 0.72 (P = 0.47)					
4 Failure to return home or dead					
Baumgaertner 1998	24/58	25/64		34.2 %	1.06 [0.69, 1.63]
Hoffmann 1999	16/54	16/52		23.5 %	0.96 [0.54, 1.72]
Harrington 2002	31/50	30/52		42.3 %	1.07 [0.78, 1.48]
Subtotal (95% CI)	**162**	**168**		**100.0 %**	**1.04 [0.82, 1.33]**
Total events: 71 (IMHS), 71 (SHS)					
Heterogeneity: Chi² = 0.11, df = 2 (P = 0.95); I² =0.0%					
Test for overall effect: Z = 0.34 (P = 0.73)					
5 Failure to return home or dead (overall denominators used)					
Baumgaertner 1998	24/65	25/64		35.5 %	0.95 [0.61, 1.47]
Hoffmann 1999	16/56	16/54		23.0 %	0.96 [0.54, 1.73]
Harrington 2002	31/50	30/52		41.5 %	1.07 [0.78, 1.48]
Subtotal (95% CI)	**171**	**170**		**100.0 %**	**1.00 [0.79, 1.28]**
Total events: 71 (IMHS), 71 (SHS)					
Heterogeneity: Chi² = 0.27, df = 2 (P = 0.88); I² =0.0%					
Test for overall effect: Z = 0.03 (P = 0.98)					
6 Failure to regain mobility					
Baumgaertner 1998	15/52	16/53		100.0 %	0.96 [0.53, 1.73]
Subtotal (95% CI)	**52**	**53**		**100.0 %**	**0.96 [0.53, 1.73]**
Total events: 15 (IMHS), 16 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.15 (P = 0.88)					
7 Poor mobility					
Hoffmann 1999	16/45	19/43		100.0 %	0.80 [0.48, 1.35]
Subtotal (95% CI)	**45**	**43**		**100.0 %**	**0.80 [0.48, 1.35]**
Total events: 16 (IMHS), 19 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.82 (P = 0.41)					



Analysis 4.1. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Saudan 2002	100	64 (33)	106	65 (26)		-1.00 [-9.14, 7.14]

-10 -5 0 5 10

Favours PFN Favours SHS

Analysis 4.2. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 2 Blood loss and transfusion.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 2 Blood loss and transfusion

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Blood loss (ml)							
Pajarinen 2005	54	320 (310)	54	357 (495)		100.0 %	-37.00 [-192.78, 118.78]
Subtotal (95% CI)	**54**		**54**			**100.0 %**	**-37.00 [-192.78, 118.78]**
Heterogeneity: not applicable							
Test for overall effect: Z = 0.47 (P = 0.64)							
2 Transfusion (units of red blood cells)							
Saudan 2002	100	1.46 (1.8)	106	1.73 (1.76)		74.6 %	-0.27 [-0.76, 0.22]
Pajarinen 2005	54	2.6 (2.4)	54	2.6 (2)		25.4 %	0.0 [-0.83, 0.83]
Subtotal (95% CI)	**154**		**160**			**100.0 %**	**-0.20 [-0.62, 0.22]**
Heterogeneity: $Chi^2 = 0.30$, df = 1 (P = 0.58); I^2 =0.0%							
Test for overall effect: Z = 0.94 (P = 0.35)							

-200 -100 0 100 200

Favours PFN Favours SHS

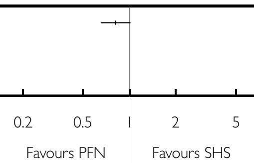
Analysis 4.3. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 3 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 3 Number of patients transfused

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Saudan 2002	55/100	72/106		0.81 [0.65, 1.01]



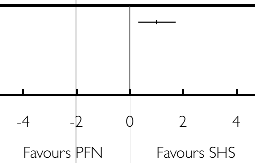
Analysis 4.4. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 4 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 4 Radiographic screening time (minutes)

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Saudan 2002	100	4 (3)	106	3 (2)		1.00 [0.30, 1.70]



Analysis 4.5. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 5 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 5 Fracture fixation complications

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Operative fracture femur					
Papasimos 2005	0/40	0/40		100.0 %	0.0 [-0.05, 0.05]
Subtotal (95% CI)	**40**	**40**		**0.0 %**	**0.0 [-0.05, 0.05]**
Total events: 0 (PFN), 0 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					
2 Later fracture of femur					
Papasimos 2005	0/40	0/40		42.6 %	0.0 [-0.05, 0.05]
Pajarinen 2005	0/54	0/54		57.4 %	0.0 [-0.04, 0.04]
Subtotal (95% CI)	**94**	**94**		**0.0 %**	**0.0 [-0.03, 0.03]**
Total events: 0 (PFN), 0 (SHS)					
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%					
Test for overall effect: Z = 0.0 (P = 1.0)					
3 Cut-out					
Saudan 2002	3/79	1/89		23.9 %	3.38 [0.36, 31.84]
Pajarinen 2005	1/54	1/54		25.4 %	1.00 [0.06, 15.58]
Papasimos 2005	1/40	2/40		50.8 %	0.50 [0.05, 5.30]
Subtotal (95% CI)	**173**	**183**		**100.0 %**	**1.31 [0.36, 4.75]**
Total events: 5 (PFN), 4 (SHS)					
Heterogeneity: Chi^2 = 1.36, df = 2 (P = 0.51); I^2 =0.0%					
Test for overall effect: Z = 0.42 (P = 0.68)					
4 Cut-out: overall denominators used					
Saudan 2002	3/100	1/106		24.4 %	3.18 [0.34, 30.07]
Pajarinen 2005	1/54	1/54		25.2 %	1.00 [0.06, 15.58]
Papasimos 2005	1/40	2/40		50.4 %	0.50 [0.05, 5.30]
Subtotal (95% CI)	**194**	**200**		**100.0 %**	**1.28 [0.35, 4.67]**
Total events: 5 (PFN), 4 (SHS)					
Heterogeneity: Chi^2 = 1.27, df = 2 (P = 0.53); I^2 =0.0%					
Test for overall effect: Z = 0.38 (P = 0.71)					
5 Non-union					
Saudan 2002	0/79	0/89		67.7 %	0.0 [-0.02, 0.02]

0.01 0.1 1 10 100

Favours PFN Favours SHS

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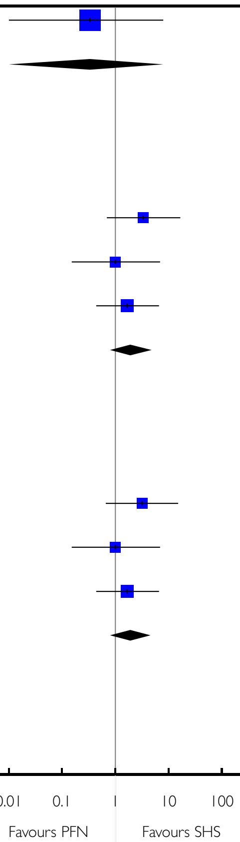
Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Papasimos 2005	0/40	1/40		100.0 %	0.33 [0.01, 7.95]
Subtotal (95% CI)	**119**	**129**		**100.0 %**	**0.33 [0.01, 7.95]**
Total events: 0 (PFN), 1 (SHS)					
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%					
Test for overall effect: Z = 0.68 (P = 0.50)					
6 Reoperation					
Saudan 2002	6/79	2/89		27.3 %	3.38 [0.70, 16.27]
Pajarinen 2005	2/54	2/54		29.1 %	1.00 [0.15, 6.84]
Papasimos 2005	5/40	3/40		43.6 %	1.67 [0.43, 6.51]
Subtotal (95% CI)	**173**	**183**		**100.0 %**	**1.94 [0.80, 4.71]**
Total events: 13 (PFN), 7 (SHS)					
Heterogeneity: Chi^2 = 0.98, df = 2 (P = 0.61); I^2 =0.0%					
Test for overall effect: Z = 1.47 (P = 0.14)					
7 Reoperation: overall denominators used					
Saudan 2002	6/100	2/106		28.0 %	3.18 [0.66, 15.39]
Pajarinen 2005	2/54	2/54		28.8 %	1.00 [0.15, 6.84]
Papasimos 2005	5/40	3/40		43.2 %	1.67 [0.43, 6.51]
Subtotal (95% CI)	**194**	**200**		**100.0 %**	**1.90 [0.78, 4.62]**
Total events: 13 (PFN), 7 (SHS)					
Heterogeneity: Chi^2 = 0.87, df = 2 (P = 0.65); I^2 =0.0%					
Test for overall effect: Z = 1.41 (P = 0.16)					



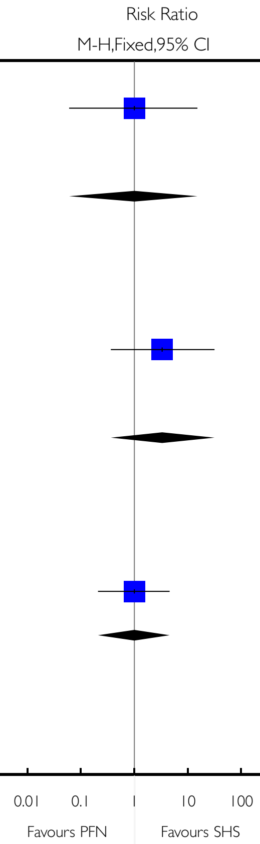
Analysis 4.6. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 6 Wound infection or haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 6 Wound infection or haematoma

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Superficial wound infection			
Papasimos 2005	1/40	1/40	1.00 [0.06, 15.44]
Pajarinen 2005	0/54	0/54	0.0 [0.0, 0.0]
Subtotal (95% CI)	**94**	**94**	**1.00 [0.06, 15.44]**
Total events: 1 (PFN), 1 (SHS)			
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); $I^2 = 0.0\%$			
Test for overall effect: Z = 0.0 (P = 1.0)			
2 Deep wound infection			
Saudan 2002	3/79	1/89	3.38 [0.36, 31.84]
Pajarinen 2005	0/54	0/54	0.0 [0.0, 0.0]
Subtotal (95% CI)	**133**	**143**	**3.38 [0.36, 31.84]**
Total events: 3 (PFN), 1 (SHS)			
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); $I^2 = 0.0\%$			
Test for overall effect: Z = 1.06 (P = 0.29)			
3 Haematoma			
Papasimos 2005	3/40	3/40	1.00 [0.21, 4.66]
Subtotal (95% CI)	**40**	**40**	**1.00 [0.21, 4.66]**
Total events: 3 (PFN), 3 (SHS)			
Heterogeneity: not applicable			
Test for overall effect: Z = 0.0 (P = 1.0)			



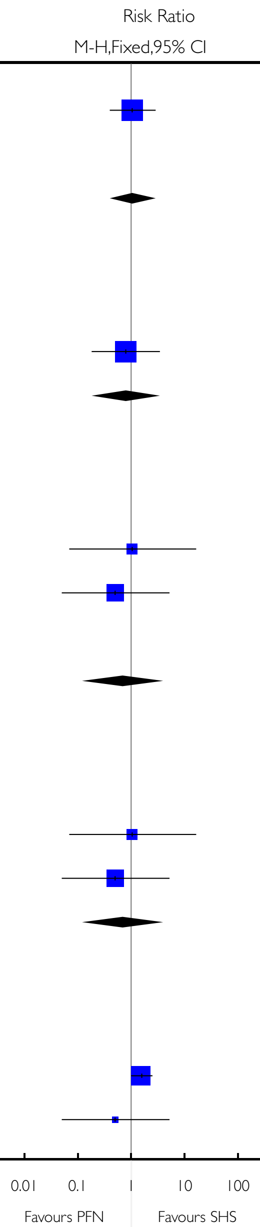
Analysis 4.7. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 7 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 7 Post-operative complications

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia			
Saudan 2002	7/100	7/106	1.06 [0.39, 2.91]
Papasimos 2005	0/40	0/40	0.0 [0.0, 0.0]
Subtotal (95% CI)	**140**	**146**	**1.06 [0.39, 2.91]**
Total events: 7 (PFN), 7 (SHS)			
Heterogeneity: Chi² = 0.0, df = 0 (P = 1.00); I² =0.0%			
Test for overall effect: Z = 0.11 (P = 0.91)			
2 Pressure sores			
Saudan 2002	3/100	4/106	0.80 [0.18, 3.46]
Subtotal (95% CI)	**100**	**106**	**0.80 [0.18, 3.46]**
Total events: 3 (PFN), 4 (SHS)			
Heterogeneity: not applicable			
Test for overall effect: Z = 0.31 (P = 0.76)			
3 Deep vein thrombosis			
Saudan 2002	1/100	1/106	1.06 [0.07, 16.72]
Papasimos 2005	1/40	2/40	0.50 [0.05, 5.30]
Pajarinen 2005	0/54	0/54	0.0 [0.0, 0.0]
Subtotal (95% CI)	**194**	**200**	**0.68 [0.12, 3.98]**
Total events: 2 (PFN), 3 (SHS)			
Heterogeneity: Chi² = 0.16, df = 1 (P = 0.68); I² =0.0%			
Test for overall effect: Z = 0.42 (P = 0.67)			
4 Pulmonary embolism			
Saudan 2002	1/100	1/106	1.06 [0.07, 16.72]
Papasimos 2005	1/40	2/40	0.50 [0.05, 5.30]
Subtotal (95% CI)	**140**	**146**	**0.68 [0.12, 3.98]**
Total events: 2 (PFN), 3 (SHS)			
Heterogeneity: Chi² = 0.16, df = 1 (P = 0.68); I² =0.0%			
Test for overall effect: Z = 0.42 (P = 0.67)			
5 Urinary tract infection			
Saudan 2002	34/100	23/106	1.57 [1.00, 2.47]
Papasimos 2005	1/40	2/40	0.50 [0.05, 5.30]



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Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**140**	**146**		**1.48 [0.95, 2.30]**
Total events: 35 (PFN), 25 (SHS)				
Heterogeneity: Chi² = 0.87, df = 1 (P = 0.35); I² =0.0%				
Test for overall effect: Z = 1.73 (P = 0.083)				
6 Any medical complication				
Saudan 2002	52/100	49/106		1.12 [0.85, 1.49]
Subtotal (95% CI)	**100**	**106**		**1.12 [0.85, 1.49]**
Total events: 52 (PFN), 49 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.83 (P = 0.41)				

0.01 0.1 1 10 100

Favours PFN Favours SHS

Analysis 4.8. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 8 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 8 Length of hospital stay (days)

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Saudan 2002	100	13 (4)	106	14 (10)		25.0 %	-1.00 [-3.06, 1.06]
Pajarinen 2005	54	6.1 (3.3)	54	5.4 (3)		75.0 %	0.70 [-0.49, 1.89]
Total (95% CI)	**154**		**160**			**100.0 %**	**0.27 [-0.76, 1.30]**
Heterogeneity: Chi² = 1.96, df = 1 (P = 0.16); I² =49%							
Test for overall effect: Z = 0.52 (P = 0.60)							

-10 -5 0 5 10

Favours PFN Favours SHS

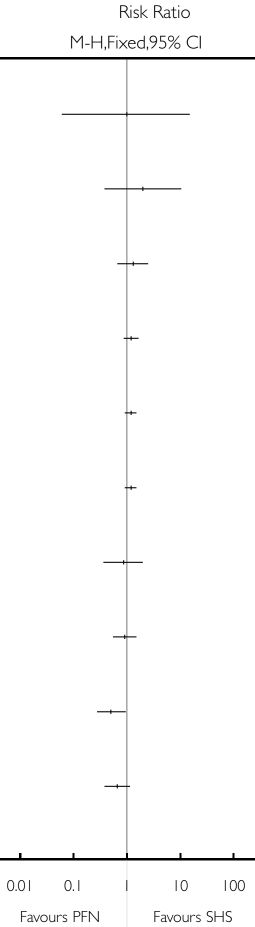
Analysis 4.9. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 9 Final outcome measures.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 9 Final outcome measures

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Mortality in hospital			
Papasimos 2005	1/40	1/40	1.00 [0.06, 15.44]
2 Mortality at 4 months			
Pajarinen 2005	4/54	2/54	2.00 [0.38, 10.47]
3 Mortality at 1 year			
Saudan 2002	16/100	13/106	1.30 [0.66, 2.57]
4 In nursing home at 1 year			
Saudan 2002	42/79	39/89	1.21 [0.89, 1.66]
5 In nursing home or dead at 1 year			
Saudan 2002	58/95	52/102	1.20 [0.93, 1.54]
6 In nursing home or dead at 1 year (overall denominators used)			
Saudan 2002	58/100	52/106	1.18 [0.92, 1.53]
7 Failure to regain pre-fracture residential status at 4 months			
Pajarinen 2005	8/42	9/41	0.87 [0.37, 2.03]
8 Failure to regain pre-fracture residential status, seriously ill or dead at 4 months			
Pajarinen 2005	18/52	20/52	0.90 [0.54, 1.50]
9 Failure to recover previous mobility at 4 months			
Pajarinen 2005	10/42	19/41	0.51 [0.27, 0.97]
10 Failure to recover previous mobility or dead at 4 months (overall denominators used)			
Pajarinen 2005	14/54	21/54	0.67 [0.38, 1.17]



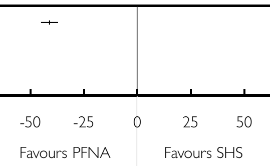
Analysis 5.1. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	PFNA N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Zou 2009	58	52 (10)	63	93 (13)		-41.00 [-45.11, -36.89]



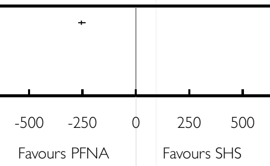
Analysis 5.2. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 2 Operative blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 2 Operative blood loss (ml)

Study or subgroup	PFNA N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Zou 2009	58	156 (24)	63	410 (65)		-254.00 [-271.20, -236.80]



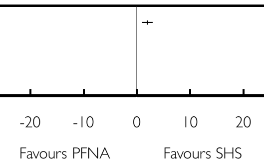
Analysis 5.3. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 3 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 3 Radiographic screening time (minutes)

Study or subgroup	PFNA N	PFNA Mean(SD)	SHS N	SHS Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Zou 2009	58	7 (3)	63	5 (2)		2.00 [1.08, 2.92]



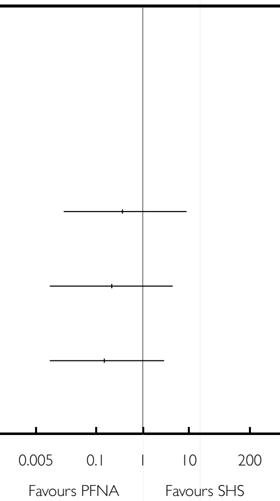
Analysis 5.4. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 4 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 4 Fracture fixation complications

Study or subgroup	PFNA n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cut-out of the implant				
Zou 2009	0/58	0/63		0.0 [0.0, 0.0]
2 Later fracture of the femur				
Zou 2009	0/58	0/63		0.0 [0.0, 0.0]
3 Fracture non-union				
Zou 2009	0/58	1/63		0.36 [0.02, 8.70]
4 Breakage of implant and/or detachment of the plate from the femur				
Zou 2009	0/58	2/63		0.22 [0.01, 4.43]
5 Reoperation for fracture fixation complications				
Zou 2009	0/58	3/63		0.15 [0.01, 2.94]



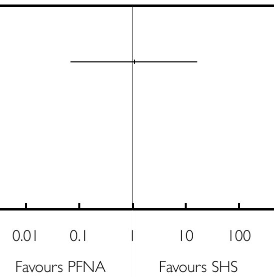
Analysis 5.5. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 5 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 5 Wound infection

Study or subgroup	PFNA n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Superficial wound infection			
Zou 2009	1/58	1/63	1.09 [0.07, 16.97]
2 Deep wound infection			
Zou 2009	0/58	0/63	0.0 [0.0, 0.0]



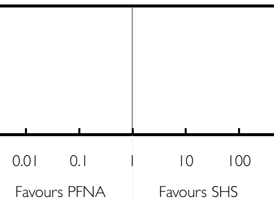
Analysis 5.6. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 6 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 6 Post-operative complications

Study or subgroup	PFNA n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Deep vein thrombosis			
Zou 2009	0/58	0/63	0.0 [0.0, 0.0]

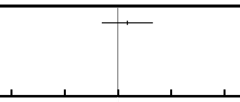


Analysis 5.7. Comparison 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS), Outcome 7 Poor or fair hip function score (1 year).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Proximal femoral nail antirotation (PFNA) versus sliding hip screw (SHS)

Outcome: 7 Poor or fair hip function score (1 year)

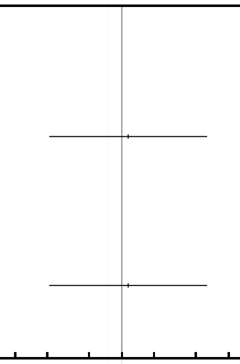
Study or subgroup	PFNA n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Zou 2009	7/58	5/63		1.52 [0.51, 4.53]

Analysis 6.1. Comparison 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 1 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 1 Fracture fixation complications

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Later fracture of the femur				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
2 Cut-out				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]
3 Non-union				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
4 Reoperation				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]

Analysis 6.2. Comparison 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 2 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 2 Wound infection

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 All wound infections				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
2 Deep wound infection				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]

0.1 0.2 0.5 1 2 5 10

Favours Targon PF Favours SHS

Analysis 6.3. Comparison 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 3 Post-operative compiications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 3 Post-operative compiications

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia				
Giraud 2005	1/34	0/26		2.31 [0.10, 54.60]
2 Deep vein thrombosis				
Giraud 2005	1/34	0/26		2.31 [0.10, 54.60]

0.01 0.1 1 10 100

Favours Targon PF Favours SHS

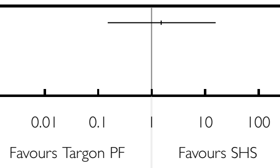
Analysis 6.4. Comparison 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 4 Mortality (3 months).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 4 Mortality (3 months)

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Giraud 2005	2/34	1/26		1.53 [0.15, 15.97]



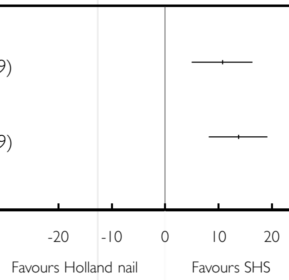
Analysis 7.1. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 1 Length of anaesthesia and surgery.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 1 Length of anaesthesia and surgery

Study or subgroup	Holland nail N	Mean(SD)	Sliding Hip Screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Length of anaesthesia (minutes)						
Little 2008	92	40.4 (24.22)	98	29.7 (13.89)		10.70 [5.04, 16.36]
2 Length of surgery (minutes)						
Little 2008	92	54 (23)	98	40.3 (14.9)		13.70 [8.15, 19.25]



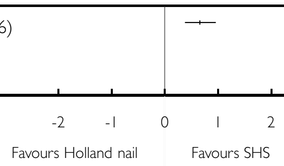
Analysis 7.2. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 2 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 2 Radiographic screening time (minutes)

Study or subgroup	Holland nail N	Mean(SD)	Sliding Hip Screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Little 2008	92	1.56 (1.22)	98	0.9 (0.76)		0.66 [0.37, 0.95]



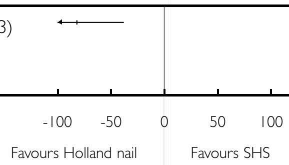
Analysis 7.3. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 3 Blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 3 Blood loss (ml)

Study or subgroup	Holland nail N	Mean(SD)	Sliding Hip Screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Little 2008	92	78 (129.68)	98	160 (179.3)		-82.00 [-126.30, -37.70]



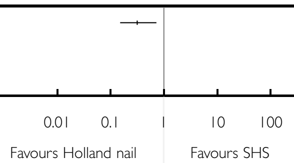
Analysis 7.4. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 4 Number of patients given transfusion.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 4 Number of patients given transfusion

Study or subgroup	Holland nail n/N	Sliding Hip Screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Little 2008	7/92	23/98		0.32 [0.15, 0.72]



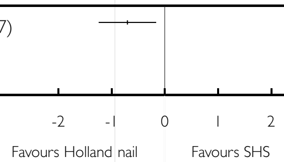
Analysis 7.5. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 5 Days till mobilisation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 5 Days till mobilisation

Study or subgroup	Holland nail N	Mean(SD)	Sliding Hip Screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Little 2008	92	3.6 (1.47)	98	4.3 (2.27)		-0.70 [-1.24, -0.16]



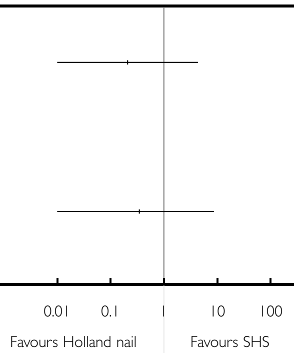
Analysis 7.6. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 6 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 6 Fracture fixation complications

Study or subgroup	Holland nail n/N	Sliding Hip Screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cut-out				
Little 2008	0/92	2/98		0.21 [0.01, 4.38]
2 Later fracture of femur				
Little 2008	0/92	0/98		0.0 [0.0, 0.0]
3 Reoperation				
Little 2008	0/92	1/98		0.35 [0.01, 8.60]



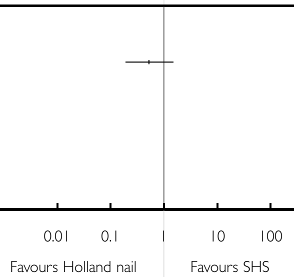
Analysis 7.7. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 7 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 7 Wound infection

Study or subgroup	Holland nail n/N	Sliding Hip Screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Superficial wound infection				
Little 2008	5/92	10/98		0.53 [0.19, 1.50]
2 Deep wound infection				
Little 2008	0/92	0/98		0.0 [0.0, 0.0]



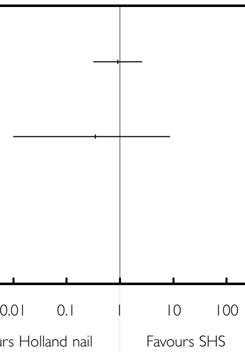
Analysis 7.8. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 8 Postoperative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 8 Postoperative complications

Study or subgroup	Holland nail n/N	Sliding Hip Screw n/N	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia			
Little 2008	6/92	7/98	0.91 [0.32, 2.62]
2 Deep vein thrombosis			
Little 2008	0/92	1/98	0.35 [0.01, 8.60]
3 Pulmonary embolism			
Little 2008	0/92	0/98	0.0 [0.0, 0.0]



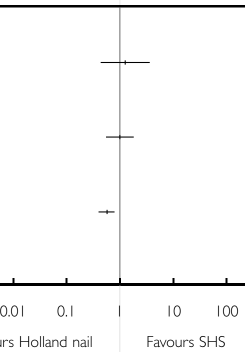
Analysis 7.9. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 9 Final outcome measures.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 9 Final outcome measures

Study or subgroup	Holland nail n/N	Sliding Hip Screw n/N	Risk Ratio M-H,Fixed,95% CI
1 Mortality at 30 days			
Little 2008	7/92	6/98	1.24 [0.43, 3.56]
2 Mortality at one year			
Little 2008	16/92	17/98	1.00 [0.54, 1.86]
3 Failure to regain mobility at one year (survivors)			
Little 2008	27/76	50/80	0.57 [0.40, 0.80]



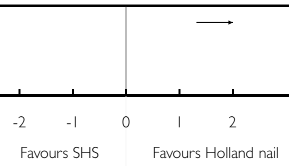
Analysis 7.10. Comparison 7 Holland nail versus sliding hip screw (SHS), Outcome 10 Final outcome measures: mobility score (0 to 9: best result).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Holland nail versus sliding hip screw (SHS)

Outcome: 10 Final outcome measures: mobility score (0 to 9: best result)

Study or subgroup	Holland nail N	Mean(SD)	Sliding Hip Screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Little 2008	76	5.9 (2.67)	80	3.8 (2.28)		2.10 [1.32, 2.88]



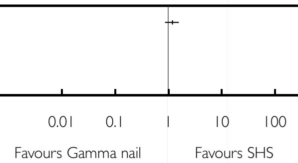
Analysis 8.1. Comparison 8 Long Gamma nail versus sliding hip screw (SHS), Outcome 1 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Long Gamma nail versus sliding hip screw (SHS)

Outcome: 1 Number of patients transfused

Study or subgroup	Long Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Barton 2010	50/100	46/110		1.20 [0.89, 1.61]



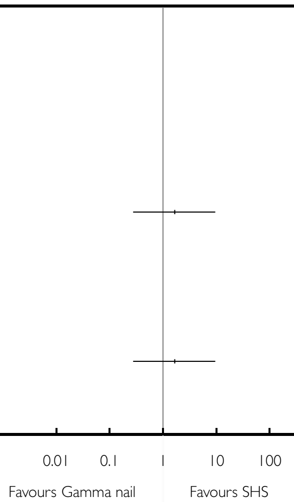
Analysis 8.2. Comparison 8 Long Gamma nail versus sliding hip screw (SHS), Outcome 2 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Long Gamma nail versus sliding hip screw (SHS)

Outcome: 2 Fracture fixation complications

Study or subgroup	Long Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Operative fracture of femur				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
2 Later fracture of the femur				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
3 Cut-out				
Barton 2010	3/100	2/110		1.65 [0.28, 9.67]
4 Non-union				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]
5 Reoperation				
Barton 2010	3/100	2/110		1.65 [0.28, 9.67]



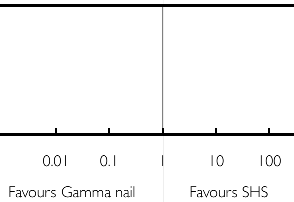
Analysis 8.3. Comparison 8 Long Gamma nail versus sliding hip screw (SHS), Outcome 3 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Long Gamma nail versus sliding hip screw (SHS)

Outcome: 3 Wound infection

Study or subgroup	Long Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Deep wound infection				
Barton 2010	0/100	0/110		0.0 [0.0, 0.0]



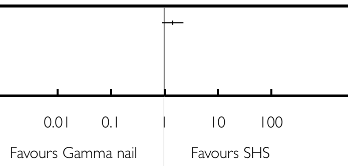
Analysis 8.4. Comparison 8 Long Gamma nail versus sliding hip screw (SHS), Outcome 4 Mortality (at one year).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Long Gamma nail versus sliding hip screw (SHS)

Outcome: 4 Mortality (at one year)

Study or subgroup	Long Gamma nail	SHS	Risk Ratio	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI	M-H,Fixed,95% CI
Barton 2010	32/100	24/110		1.47 [0.93, 2.31]



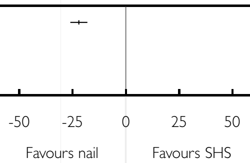
Analysis 9.1. Comparison 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Mini-invasive nail		Sliding hip screw		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
Dujardin 2001	30	24 (7)	30	46 (9)		-22.00 [-26.08, -17.92]



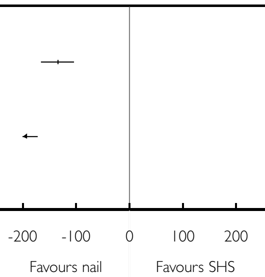
Analysis 9.2. Comparison 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 2 Blood loss.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 2 Blood loss

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI
1 Operative blood loss (ml)					
Dujardin 2001	30	37 (39)	30	172 (76)	-135.00 [-165.57, -104.43]
2 Total blood loss (ml)					
Dujardin 2001	30	90 (75)	30	326 (161)	-236.00 [-299.56, -172.44]



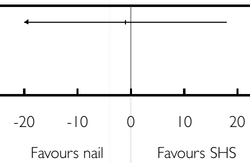
Analysis 9.3. Comparison 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 3 Radiographic screening time (seconds).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 3 Radiographic screening time (seconds)

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI
Dujardin 2001	30	62 (35)	30	63 (40)	-1.00 [-20.02, 18.02]



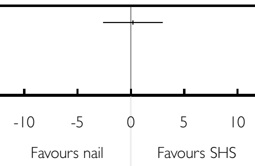
Analysis 9.4. Comparison 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 4 Time to radiographic healing (weeks).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 4 Time to radiographic healing (weeks)

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Dujardin 2001	30	10.4 (5.7)	30	10.2 (5.3)		0.20 [-2.59, 2.99]



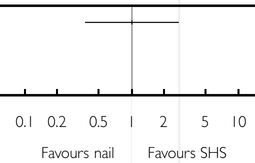
Analysis 9.5. Comparison 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 5 Mortality (6 months).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 5 Mortality (6 months)

Study or subgroup	Mini-invasive nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Dujardin 2001	6/30	6/30		1.00 [0.36, 2.75]



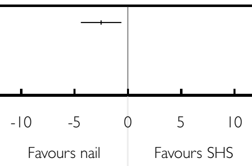
Analysis 9.6. Comparison 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 6 Time to effective weight bearing (weeks).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 6 Time to effective weight bearing (weeks)

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Dujardin 2001	21	5.8 (2.1)	22	8.3 (4)		-2.50 [-4.40, -0.60]



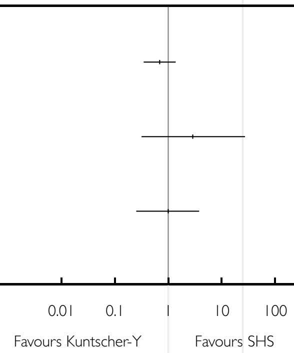
Analysis 10.1. Comparison 10 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 1 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 10 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 1 Fracture fixation complications

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cut-out				
Davis 1988	12/116	17/114		0.69 [0.35, 1.39]
2 Implant breakage, bending or uncoupling				
Davis 1988	3/116	1/114		2.95 [0.31, 27.93]
3 Reoperation				
Davis 1988	4/116	4/114		0.98 [0.25, 3.84]



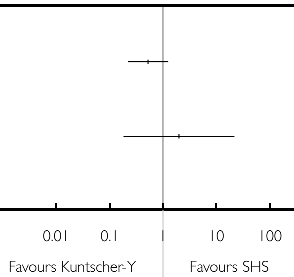
Analysis 10.2. Comparison 10 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 2 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 10 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 2 Wound infection

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Superficial wound infection				
Davis 1988	7/116	13/114		0.53 [0.22, 1.28]
2 Deep wound infection				
Davis 1988	2/116	1/114		1.97 [0.18, 21.38]



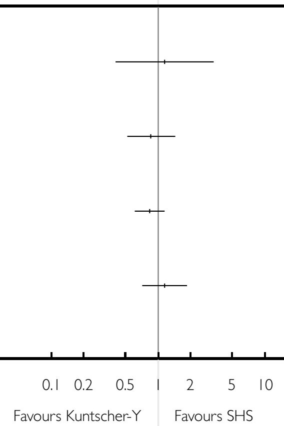
Analysis 10.3. Comparison 10 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 3 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 10 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 3 Post-operative complications

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Thromboembolic complications				
Davis 1988	7/116	6/114		1.15 [0.40, 3.31]
2 Pneumonia				
Davis 1988	21/116	24/114		0.86 [0.51, 1.45]
3 Pressure sores				
Davis 1988	42/116	50/114		0.83 [0.60, 1.14]
4 Urinary infection				
Davis 1988	28/116	24/114		1.15 [0.71, 1.85]



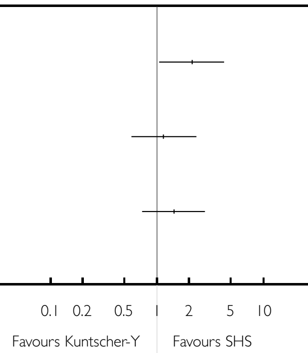
Analysis 10.4. Comparison 10 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 4 Anatomical deformity.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 10 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 4 Anatomical deformity

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Leg shortening > 2.5 cm				
Davis 1988	17/48	9/54		2.13 [1.05, 4.31]
2 Varus deformity > 15 degrees				
Davis 1988	13/68	12/73		1.16 [0.57, 2.37]
3 External rotation deformity > 15 degrees				
Davis 1988	14/48	11/54		1.43 [0.72, 2.85]



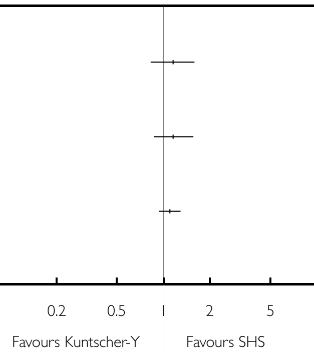
Analysis 10.5. Comparison 10 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 5 Final outcome measures (1 year).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 10 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 5 Final outcome measures (1 year)

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Mortality				
Davis 1988	48/116	41/114		1.15 [0.83, 1.60]
2 Failure to regain pre-fracture mobility				
Davis 1988	40/68	37/73		1.16 [0.86, 1.57]
3 Death or failure to regain pre-fracture mobility				
Davis 1988	88/116	78/114		1.11 [0.94, 1.30]



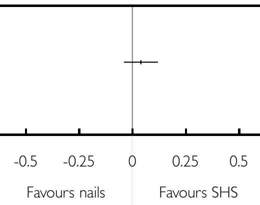
Analysis 11.1. Comparison 11 Two nail types versus sliding hip screw (SHS), Outcome 1 Operative outcomes.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 11 Two nail types versus sliding hip screw (SHS)

Outcome: 1 Operative outcomes

Study or subgroup	Two nail types N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Radiographic exposure (Gy/m^2)						
Verettas 2010	59	0.44 (0.21)	59	0.4 (0.21)		0.04 [-0.04, 0.12]



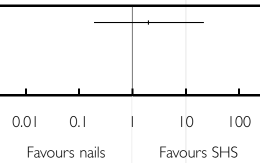
Analysis 11.2. Comparison 11 Two nail types versus sliding hip screw (SHS), Outcome 2 Operative fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 11 Two nail types versus sliding hip screw (SHS)

Outcome: 2 Operative fracture of the femur

Study or subgroup	Two nail types n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Verettas 2010	2/59	1/59		2.00 [0.19, 21.46]



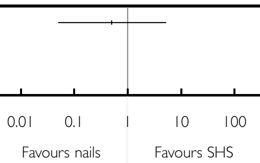
Analysis 11.3. Comparison 11 Two nail types versus sliding hip screw (SHS), Outcome 3 Superficial wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 11 Two nail types versus sliding hip screw (SHS)

Outcome: 3 Superficial wound infection

Study or subgroup	Two nail types n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Verettas 2010	1/59	2/59		0.50 [0.05, 5.37]



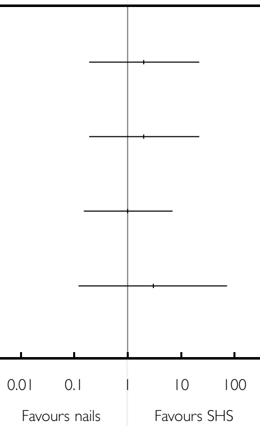
Analysis 11.4. Comparison 11 Two nail types versus sliding hip screw (SHS), Outcome 4 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 11 Two nail types versus sliding hip screw (SHS)

Outcome: 4 Post-operative complications

Study or subgroup	Two nail types n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Deep vein thrombosis				
Verettas 2010	2/59	1/59		2.00 [0.19, 21.46]
2 Delirium				
Verettas 2010	2/59	1/59		2.00 [0.19, 21.46]
3 Cardiovascular complication				
Verettas 2010	2/59	2/59		1.00 [0.15, 6.87]
4 Respiratory complication				
Verettas 2010	1/59	0/59		3.00 [0.12, 72.18]



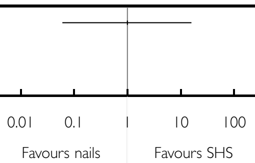
Analysis 11.5. Comparison 11 Two nail types versus sliding hip screw (SHS), Outcome 5 Mortality (in hospital).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 11 Two nail types versus sliding hip screw (SHS)

Outcome: 5 Mortality (in hospital)

Study or subgroup	Two nail types n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Verettas 2010	1/60	1/60		1.00 [0.06, 15.62]



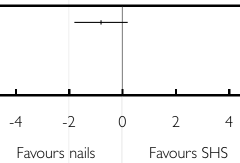
Analysis 11.6. Comparison 11 Two nail types versus sliding hip screw (SHS), Outcome 6 Days to independent walking.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 11 Two nail types versus sliding hip screw (SHS)

Outcome: 6 Days to independent walking

Study or subgroup	Two nail types N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Verettas 2010	59	7.4 (2.6)	59	8.2 (2.9)		-0.80 [-1.79, 0.19]



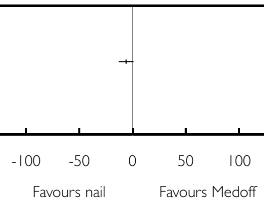
Analysis 12.1. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Intramedullary nail		Medoff plate		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 Proximal femoral nail (PFN)						
Ekstrom 2007	105	56 (21)	98	62 (29)		-6.00 [-13.01, 1.01]



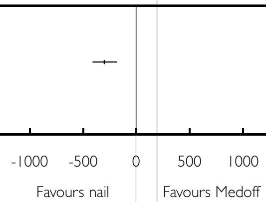
Analysis 12.2. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 2 Operative blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 2 Operative blood loss (ml)

Study or subgroup	Intramedullary nail		Medoff plate		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 Proximal femoral nail (PFN)						
Ekstrom 2007	105	230 (185)	98	527 (565)		-297.00 [-414.33, -179.67]



Analysis 12.3. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 3 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 3 Radiographic screening time (minutes)

Study or subgroup	Intramedullary nail N	Mean(SD)	Medoff plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN)						
Ekstrom 2007	105	7 (4)	98	5 (5)		2.00 [0.75, 3.25]

-10 -5 0 5 10

Favours nail Favours Medoff

Analysis 12.4. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 4 Operative fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 4 Operative fracture of the femur

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	3/109	0/108		49.3 %	6.94 [0.36, 132.70]
Subtotal (95% CI)	**109**	**108**		**49.3 %**	**6.94 [0.36, 132.70]**
Total events: 3 (Intramedullary nail), 0 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.29 (P = 0.20)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	1/105	0/98		50.7 %	2.80 [0.12, 67.98]
Subtotal (95% CI)	**105**	**98**		**50.7 %**	**2.80 [0.12, 67.98]**
Total events: 1 (Intramedullary nail), 0 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.63 (P = 0.53)					
Total (95% CI)	**214**	**206**		**100.0 %**	**4.84 [0.57, 40.81]**
Total events: 4 (Intramedullary nail), 0 (Medoff plate)					
Heterogeneity: Chi^2 = 0.17, df = 1 (P = 0.68); I^2 =0.0%					
Test for overall effect: Z = 1.45 (P = 0.15)					

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours Medoff

Analysis 12.5. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 5 Later fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 5 Later fracture of femur

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	0/109	0/108		0.0 [0.0, 0.0]
Subtotal (95% CI)	**109**	**108**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
2 Proximal femoral nail (PFN)				
Ekstrom 2007	0/105	0/98		0.0 [0.0, 0.0]
Subtotal (95% CI)	**105**	**98**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**214**	**206**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Medoff plate)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P<0.00001); I^2 =0.0%				
Test for overall effect: Z = 0.0 (P < 0.00001)				

0.1 0.2 0.5 1 2 5 10

Favours nail Favours Medoff

Analysis 12.6. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 6 Cut-out.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 6 Cut-out

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	3/109	4/108		66.0 %	0.74 [0.17, 3.24]
Subtotal (95% CI)	**109**	**108**		**66.0 %**	**0.74 [0.17, 3.24]**
Total events: 3 (Intramedullary nail), 4 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.40 (P = 0.69)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	6/105	2/98		34.0 %	2.80 [0.58, 13.55]
Subtotal (95% CI)	**105**	**98**		**34.0 %**	**2.80 [0.58, 13.55]**
Total events: 6 (Intramedullary nail), 2 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.28 (P = 0.20)					
Total (95% CI)	**214**	**206**		**100.0 %**	**1.44 [0.52, 4.01]**
Total events: 9 (Intramedullary nail), 6 (Medoff plate)					
Heterogeneity: Chi^2 = 1.46, df = 1 (P = 0.23); I^2 =31%					
Test for overall effect: Z = 0.70 (P = 0.48)					

0.01 0.1 1 10 100

Favours nail Favours Medoff

Analysis 12.7. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 7 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 7 Non-union

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	0/105	2/98		0.19 [0.01, 3.84]

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours Medoff

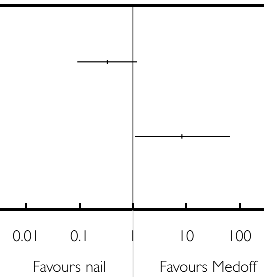
Analysis 12.8. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 8 Reoperation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 8 Reoperation

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	3/109	9/108		0.33 [0.09, 1.19]
2 Proximal femoral nail (PFN)				
Ekstrom 2007	9/105	1/98		8.40 [1.08, 65.09]



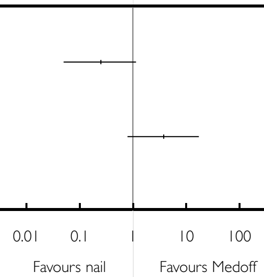
Analysis 12.9. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 9 Wound infection - any type.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 9 Wound infection - any type

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	2/109	8/108		0.25 [0.05, 1.14]
2 Proximal femoral nail (PFN)				
Ekstrom 2007	8/105	2/98		3.73 [0.81, 17.15]



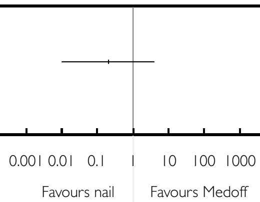
Analysis 12.10. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 10 Deep wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 10 Deep wound infection

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	0/109	2/108		0.20 [0.01, 4.08]



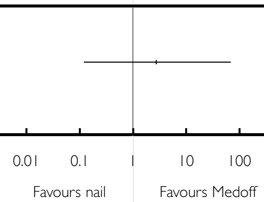
Analysis 12.11. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 11 Wound haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 11 Wound haematoma

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	1/105	0/98		2.80 [0.12, 67.98]



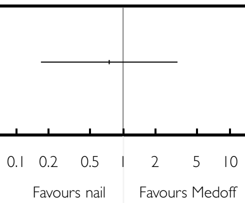
Analysis 12.12. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 12 Severe medical complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 12 Severe medical complications

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	3/109	4/108		0.74 [0.17, 3.24]



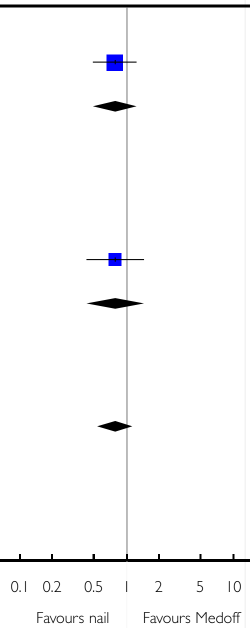
Analysis 12.13. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 13 Mortality at 1 year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 13 Mortality at 1 year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	24/109	31/108		62.6 %	0.77 [0.48, 1.22]
Subtotal (95% CI)	**109**	**108**		**62.6 %**	**0.77 [0.48, 1.22]**
Total events: 24 (Intramedullary nail), 31 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.13 (P = 0.26)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	15/105	18/98		37.4 %	0.78 [0.42, 1.46]
Subtotal (95% CI)	**105**	**98**		**37.4 %**	**0.78 [0.42, 1.46]**
Total events: 15 (Intramedullary nail), 18 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.78 (P = 0.43)					
Total (95% CI)	**214**	**206**		**100.0 %**	**0.77 [0.53, 1.12]**
Total events: 39 (Intramedullary nail), 49 (Medoff plate)					
Heterogeneity: $Chi^2 = 0.00$, df = 1 (P = 0.97); I^2 =0.0%					
Test for overall effect: Z = 1.37 (P = 0.17)					



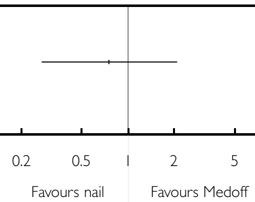
Analysis 12.14. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 14 Inability to walk 15 metres at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 14 Inability to walk 15 metres at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	6/64	7/56		0.75 [0.27, 2.10]



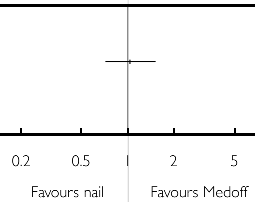
Analysis 12.15. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 15 Inability to rise from a chair at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 15 Inability to rise from a chair at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	31/64	26/56		1.04 [0.71, 1.52]



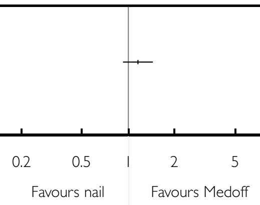
Analysis 12.16. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 16 Inability to climb a curb at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 16 Inability to climb a curb at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	50/64	38/56		1.15 [0.92, 1.44]



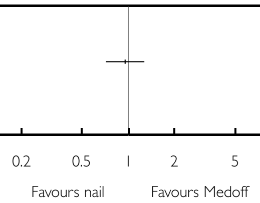
Analysis 12.17. Comparison 12 Femoral nail (2 types) versus Medoff sliding plate, Outcome 17 Need to use walking aids at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 12 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 17 Need to use walking aids at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	38/64	35/56		0.95 [0.71, 1.27]



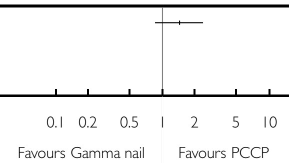
Analysis 13.1. Comparison 13 Gamma nail versus percutaneous compression plate (PCCP), Outcome 1 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 13 Gamma nail versus percutaneous compression plate (PCCP)

Outcome: 1 Number of patients transfused

Study or subgroup	Gamma nail n/N	PCCP n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Varela-Egocheaga 2009	20/40	14/40		1.43 [0.85, 2.41]



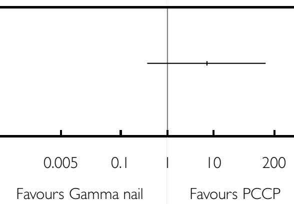
Analysis 13.2. Comparison 13 Gamma nail versus percutaneous compression plate (PCCP), Outcome 2 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 13 Gamma nail versus percutaneous compression plate (PCCP)

Outcome: 2 Fracture fixation complications

Study or subgroup	Gamma nail n/N	PCCP n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cut-out				
Varela-Egocheaga 2009	3/40	0/40		7.00 [0.37, 131.28]



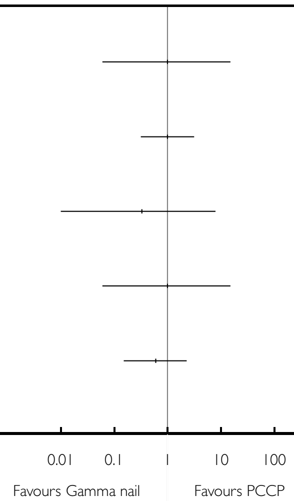
Analysis 13.3. Comparison 13 Gamma nail versus percutaneous compression plate (PCCP), Outcome 3 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 13 Gamma nail versus percutaneous compression plate (PCCP)

Outcome: 3 Post-operative complications

Study or subgroup	Gamma nail n/N	PCCP n/N	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia			
Varela-Egocheaga 2009	1/40	1/40	1.00 [0.06, 15.44]
2 Confusion			
Varela-Egocheaga 2009	5/40	5/40	1.00 [0.31, 3.19]
3 Stroke			
Varela-Egocheaga 2009	0/40	1/40	0.33 [0.01, 7.95]
4 Congestive cardiac failure			
Varela-Egocheaga 2009	1/40	1/40	1.00 [0.06, 15.44]
5 Genitourinary infection			
Varela-Egocheaga 2009	3/40	5/40	0.60 [0.15, 2.34]



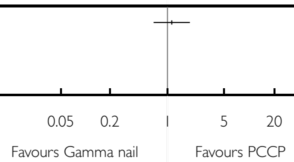
Analysis 13.4. Comparison 13 Gamma nail versus percutaneous compression plate (PCCP), Outcome 4 Discharged to intermediate care.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 13 Gamma nail versus percutaneous compression plate (PCCP)

Outcome: 4 Discharged to intermediate care

Study or subgroup	Gamma nail n/N	PCCP n/N	Risk Ratio M-H,Fixed,95% CI
Varela-Egocheaga 2009	18/39	16/39	1.13 [0.68, 1.87]



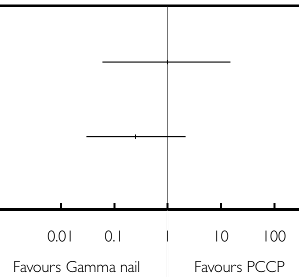
Analysis 13.5. Comparison 13 Gamma nail versus percutaneous compression plate (PCCP), Outcome 5 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 13 Gamma nail versus percutaneous compression plate (PCCP)

Outcome: 5 Mortality

Study or subgroup	Gamma nail n/N	PCCP n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Hospital mortality				
Varela-Egocheaga 2009	1/40	1/40		1.00 [0.06, 15.44]
2 Mortality (one year)				
Varela-Egocheaga 2009	1/40	4/40		0.25 [0.03, 2.14]



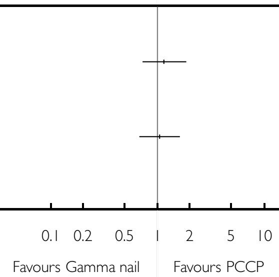
Analysis 13.6. Comparison 13 Gamma nail versus percutaneous compression plate (PCCP), Outcome 6 Failure to regain mobility at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 13 Gamma nail versus percutaneous compression plate (PCCP)

Outcome: 6 Failure to regain mobility at one year

Study or subgroup	Gamma nail n/N	PCCP n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 In survivors				
Varela-Egocheaga 2009	20/39	16/36		1.15 [0.72, 1.86]
2 Dead or failed to recover former mobility				
Varela-Egocheaga 2009	21/40	20/40		1.05 [0.68, 1.61]



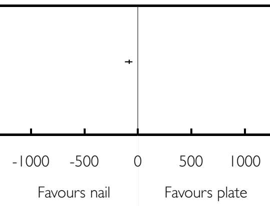
Analysis 14.1. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Intramedullary nail N	Mean(SD)	Plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)						
Sadowski 2002	20	82 (53)	19	166 (48)		-84.00 [-115.71, -52.29]



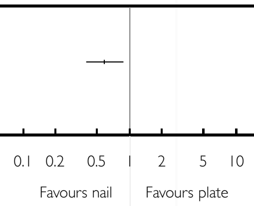
Analysis 14.2. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 2 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 2 Number of patients transfused

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	11/20	18/19		0.58 [0.39, 0.88]



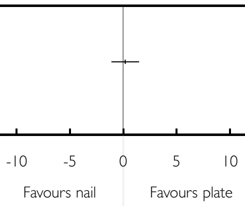
Analysis 14.3. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 3 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 3 Radiographic screening time (minutes)

Study or subgroup	Intramedullary nail N	Mean(SD)	Plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)						
Sadowski 2002	20	4.2 (2.4)	19	4 (1.6)		0.20 [-1.07, 1.47]



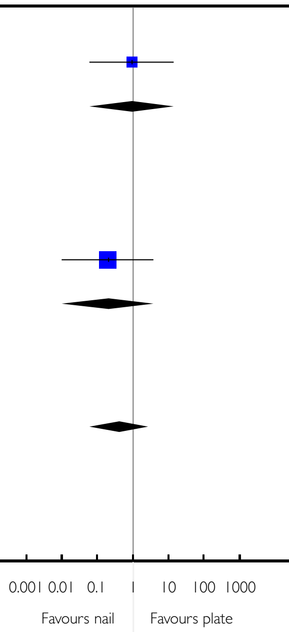
Analysis 14.4. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 4 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 4 Non-union

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)					
Sadowski 2002	1/18	1/17		29.1 %	0.94 [0.06, 13.93]
Subtotal (95% CI)	**18**	**17**		**29.1 %**	**0.94 [0.06, 13.93]**
Total events: 1 (Intramedullary nail), 1 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.04 (P = 0.97)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	0/13	2/13		70.9 %	0.20 [0.01, 3.80]
Subtotal (95% CI)	**13**	**13**		**70.9 %**	**0.20 [0.01, 3.80]**
Total events: 0 (Intramedullary nail), 2 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.07 (P = 0.28)					
Total (95% CI)	**31**	**30**		**100.0 %**	**0.42 [0.06, 2.69]**
Total events: 1 (Intramedullary nail), 3 (Plate)					
Heterogeneity: $Chi^2 = 0.59$, df = 1 (P = 0.44); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.92 (P = 0.36)					



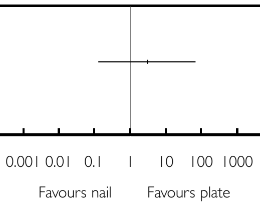
Analysis 14.5. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 5 Operative fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 5 Operative fracture of femur

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail versus 90 degree blade plate				
Pelet 2001	1/13	0/13		3.00 [0.13, 67.51]



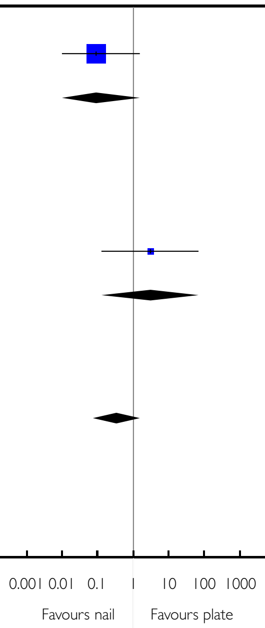
Analysis 14.6. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 6 Cut-out.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 6 Cut-out

Study or subgroup	Intramedullary nail n/N	fixation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)					
Sadowski 2002	0/20	5/19		91.8 %	0.09 [0.01, 1.47]
Subtotal (95% CI)	**20**	**19**		**91.8 %**	**0.09 [0.01, 1.47]**
Total events: 0 (Intramedullary nail), 5 (fixation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.69 (P = 0.090)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	1/13	0/13		8.2 %	3.00 [0.13, 67.51]
Subtotal (95% CI)	**13**	**13**		**8.2 %**	**3.00 [0.13, 67.51]**
Total events: 1 (Intramedullary nail), 0 (fixation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.69 (P = 0.49)					
Total (95% CI)	**33**	**32**		**100.0 %**	**0.32 [0.07, 1.53]**
Total events: 1 (Intramedullary nail), 5 (fixation)					
Heterogeneity: Chi^2 = 2.80, df = 1 (P = 0.09); I^2 =64%					
Test for overall effect: Z = 1.43 (P = 0.15)					



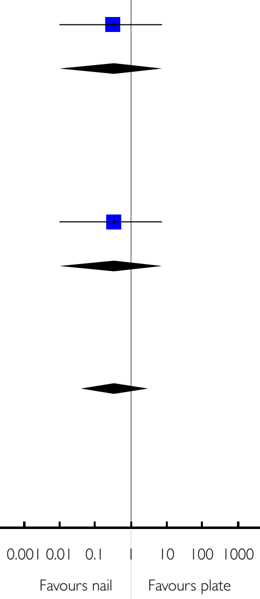
Analysis 14.7. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 7 Plate breakage.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 7 Plate breakage

Study or subgroup	Intramedullary nail n/N	fixation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)					
Sadowski 2002	0/20	1/19		50.6 %	0.32 [0.01, 7.35]
Subtotal (95% CI)	**20**	**19**		**50.6 %**	**0.32 [0.01, 7.35]**
Total events: 0 (Intramedullary nail), 1 (fixation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.72 (P = 0.47)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	0/13	1/13		49.4 %	0.33 [0.01, 7.50]
Subtotal (95% CI)	**13**	**13**		**49.4 %**	**0.33 [0.01, 7.50]**
Total events: 0 (Intramedullary nail), 1 (fixation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.69 (P = 0.49)					
Total (95% CI)	**33**	**32**		**100.0 %**	**0.33 [0.04, 2.97]**
Total events: 0 (Intramedullary nail), 2 (fixation)					
Heterogeneity: Chi² = 0.00, df = 1 (P = 0.98); I² =0.0%					
Test for overall effect: Z = 1.00 (P = 0.32)					



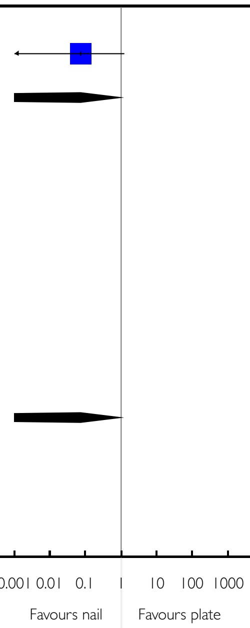
Analysis 14.8. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 8 Reoperation (major).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 8 Reoperation (major)

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	0/20	6/19		0.07 [0.00, 1.22]
Subtotal (95% CI)	**20**	**19**		**0.07 [0.00, 1.22]**
Total events: 0 (Intramedullary nail), 6 (Plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 1.82 (P = 0.068)				
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	0/13	0/13		0.0 [0.0, 0.0]
Subtotal (95% CI)	**13**	**13**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**33**	**32**		**0.07 [0.00, 1.22]**
Total events: 0 (Intramedullary nail), 6 (Plate)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 1.82 (P = 0.068)				



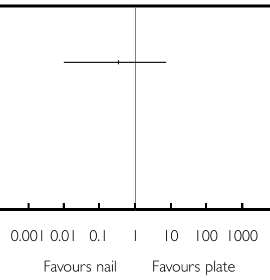
Analysis 14.9. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 9 Deep wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 9 Deep wound infection

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	0/18	1/17		0.32 [0.01, 7.26]
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	0/13	0/13		0.0 [0.0, 0.0]



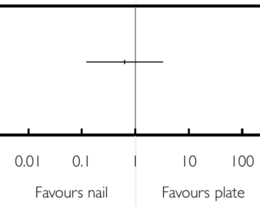
Analysis 14.10. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 10 Pneumonia.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 10 Pneumonia

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	2/20	3/19		0.63 [0.12, 3.38]



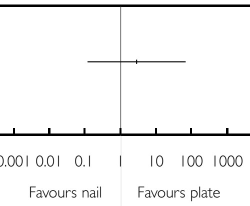
Analysis 14.11. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 11 Pressure sores.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 11 Pressure sores

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	1/20	0/19		2.86 [0.12, 66.11]



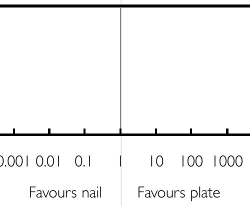
Analysis 14.12. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 12 Deep vein thrombosis.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 12 Deep vein thrombosis

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	0/20	0/19		0.0 [0.0, 0.0]



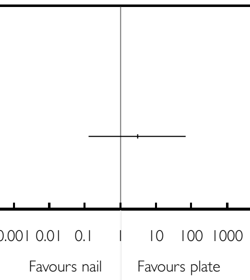
Analysis 14.13. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 13 Pulmonary embolism.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 13 Pulmonary embolism

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	0/20	0/19		0.0 [0.0, 0.0]
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	1/13	0/13		3.00 [0.13, 67.51]



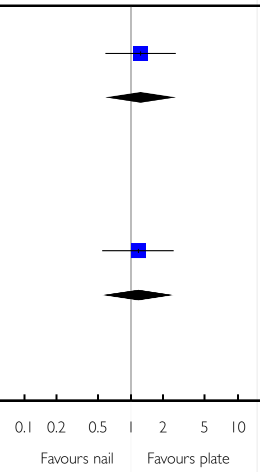
Analysis 14.14. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 14 All medical complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 14 All medical complications

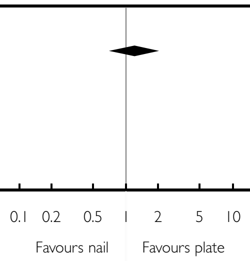
Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)					
Sadowski 2002	9/20	7/19		54.5 %	1.22 [0.57, 2.62]
Subtotal (95% CI)	**20**	**19**		**54.5 %**	**1.22 [0.57, 2.62]**
Total events: 9 (Intramedullary nail), 7 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.51 (P = 0.61)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	7/13	6/13		45.5 %	1.17 [0.54, 2.53]
Subtotal (95% CI)	**13**	**13**		**45.5 %**	**1.17 [0.54, 2.53]**
Total events: 7 (Intramedullary nail), 6 (Plate)					
Heterogeneity: not applicable					



(*Continued . . .*)

(. . . *Continued*)

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.39 (P = 0.70)					
Total (95% CI)	**33**	**32**		**100.0 %**	**1.20 [0.69, 2.06]**
Total events: 16 (Intramedullary nail), 13 (Plate)					
Heterogeneity: $Chi^2 = 0.01$, df = 1 (P = 0.93); I^2 =0.0%					
Test for overall effect: Z = 0.65 (P = 0.52)					



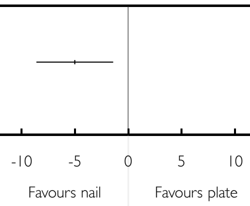
Analysis 14.15. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 15 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 15 Length of hospital stay (days)

Study or subgroup	Intramedullary nail N	Mean(SD)	Plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)						
Sadowski 2002	20	13 (4)	19	18 (7)		-5.00 [-8.60, -1.40]



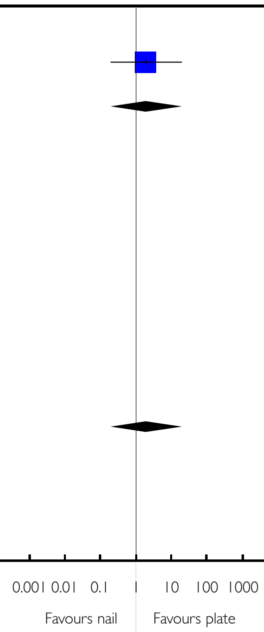
Analysis 14.16. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 16 Mortality (1 year).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 16 Mortality (1 year)

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	2/20	1/19		1.90 [0.19, 19.27]
Subtotal (95% CI)	**20**	**19**		**1.90 [0.19, 19.27]**
Total events: 2 (Intramedullary nail), 1 (Plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.54 (P = 0.59)				
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	0/13	0/13		0.0 [0.0, 0.0]
Subtotal (95% CI)	**13**	**13**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**33**	**32**		**1.90 [0.19, 19.27]**
Total events: 2 (Intramedullary nail), 1 (Plate)				
Heterogeneity: Chi² = 0.0, df = 0 (P = 1.00); I² =0.0%				
Test for overall effect: Z = 0.54 (P = 0.59)				



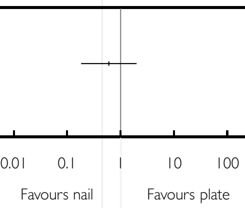
Analysis 14.17. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 17 Pain at follow-up.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 17 Pain at follow-up

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail versus 90 degree blade plate				
Pelet 2001	3/13	5/13		0.60 [0.18, 2.01]



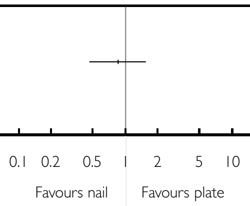
Analysis 14.18. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 18 In nursing home at one year from injury.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 18 In nursing home at one year from injury

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	9/18	10/17		0.85 [0.46, 1.56]



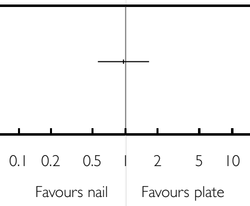
Analysis 14.19. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 19 In nursing home or dead at one year from injury.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 19 In nursing home or dead at one year from injury

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic condylar screw (DCS)				
Sadowski 2002	11/20	11/19		0.95 [0.55, 1.65]



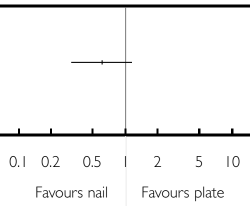
Analysis 14.20. Comparison 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures, Outcome 20 Use of walking aids.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 14 Femoral nail versus condylar screw or blade plate for trochanteric fractures

Outcome: 20 Use of walking aids

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail versus 90 degree blade plate				
Pelet 2001	6/13	10/13		0.60 [0.31, 1.16]



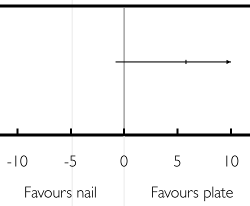
Analysis 15.1. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Nail N	Mean(SD)	DCP or blade plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw						
Lee 2007	34	80.1 (12.7)	32	74.3 (14.6)		5.80 [-0.82, 12.42]



Analysis 15.2. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 2 Radiographic screening time (seconds).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 2 Radiographic screening time (seconds)

Study or subgroup	Nail		DCP or blade plate		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw						
Lee 2007	24	84.9 (23.7)	32	65.5 (20.2)		19.40 [7.61, 31.19]
					-50 -25 0 25 50	
					Favours nail Favours plate	

Analysis 15.3. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 3 Operative blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 3 Operative blood loss (ml)

Study or subgroup	Nail		DCP or blade plate		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw						
Lee 2007	34	543 (265)	32	385 (122)		158.00 [59.40, 256.60]
					-200 -100 0 100 200	
					Favours nail Favours plate	

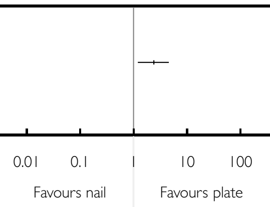
Analysis 15.4. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 4 Number of patients given transfusion.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 4 Number of patients given transfusion

Study or subgroup	Nail n/N	DCP or blade plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw				
Lee 2007	20/34	8/32		2.35 [1.21, 4.56]



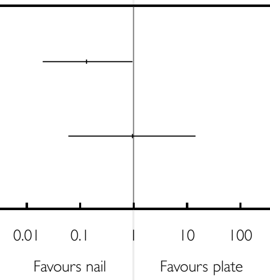
Analysis 15.5. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 5 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 5 Non-union

Study or subgroup	Nail n/N	DCP or blade plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus 95 degree blade plate				
Rahme 2007	1/30	8/30		0.13 [0.02, 0.94]
2 Russell-Taylor nail versus Dynamic condylar screw				
Lee 2007	1/34	1/32		0.94 [0.06, 14.42]



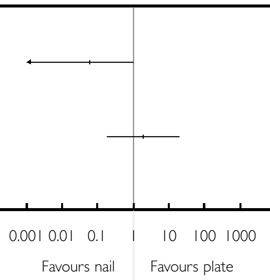
Analysis 15.6. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 6 Reoperation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 6 Reoperation

Study or subgroup	Nail n/N	DCP or blade plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus 95 degree blade plate				
Rahme 2007	0/30	8/30		0.06 [0.00, 0.98]
2 Russell-Taylor nail versus Dynamic condylar screw				
Lee 2007	2/34	1/32		1.88 [0.18, 19.77]



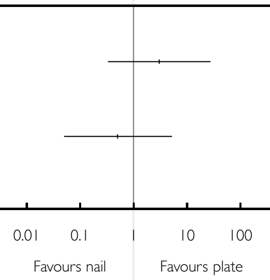
Analysis 15.7. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 7 Any wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 7 Any wound infection

Study or subgroup	Nail n/N	DCP or blade plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus 95 degree blade plate				
Rahme 2007	3/30	1/30		3.00 [0.33, 27.23]
2 Russell-Taylor nail versus Dynamic Condylar Screw				
Lee 2007	1/34	2/34		0.50 [0.05, 5.26]



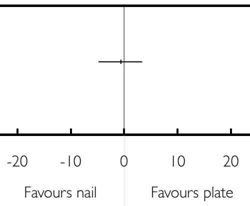
Analysis 15.8. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 8 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 8 Length of hospital stay (days)

Study or subgroup	Nail N	Mean(SD)	DCP or blade plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw						
Lee 2007	34	12.9 (6.9)	32	13.6 (9.6)		-0.70 [-4.75, 3.35]



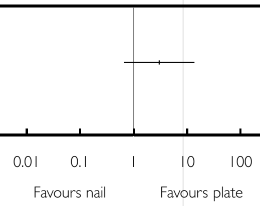
Analysis 15.9. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 9 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 9 Mortality

Study or subgroup	Nail n/N	DCP or blade plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus 95 degree blade plate				
Rahme 2007	6/30	2/30		3.00 [0.66, 13.69]



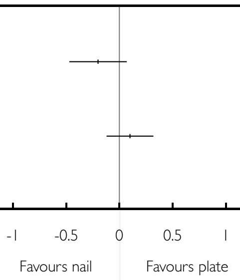
Analysis 15.10. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 10 Pain score (1: no pain to 4: worst pain).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 10 Pain score (1: no pain to 4: worst pain)

Study or subgroup	Nail N	Nail Mean(SD)	DCP or blade plate N	DCP or blade plate Mean(SD)	Mean Difference IV,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw. Hip pain					
Lee 2007	34	1.2 (0.5)	32	1.4 (0.6)	-0.20 [-0.47, 0.07]
2 Russell-Taylor nail versus Dynamic condylar screw. Thigh pain					
Lee 2007	34	1.3 (0.5)	32	1.2 (0.4)	0.10 [-0.12, 0.32]



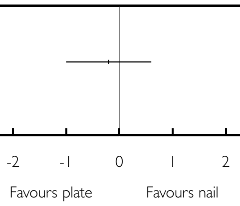
Analysis 15.11. Comparison 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures, Outcome 11 Mobility score (0: complete disability, 9: no difficulty).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 15 Femoral nail versus condylar screw or blade plate for subtrochanteric fractures

Outcome: 11 Mobility score (0: complete disability, 9: no difficulty)

Study or subgroup	Nail N	Nail Mean(SD)	DCP or blade plate N	DCP or blade plate Mean(SD)	Mean Difference IV,Fixed,95% CI
1 Russell-Taylor nail versus Dynamic condylar screw					
Lee 2007	34	7.4 (1.6)	32	7.6 (1.7)	-0.20 [-1.00, 0.60]



APPENDICES

Appendix 1. Search strategies

The Cochrane Library (Wiley InterScience)

#1 MeSH descriptor Hip Fractures explode all trees (893)
#2 ((hip* or femur* or femoral* or trochant* or pertrochant* or intertrochant* or subtrochant* or intracapsular* or extracapsular*) NEAR fracture*):ti,ab,kw (1957)
#3 (#1 OR #2) (1957)
#4 4 (pin* or nail* or screw* or plate* or arthroplasty* or fix* or prosthes*):ti,ab,kw (30380)
#5 MeSH descriptor Internal Fixators, this term only (98)
#6 MeSH descriptor Bone Screws, this term only (381)
#7 MeSH descriptor Fracture Fixation, Internal explode all trees (611)
#8 MeSH descriptor Bone Plates, this term only (198)
#9 MeSH descriptor Bone Nails, this term only (239)
#10 MeSH descriptor Arthroplasty explode all trees (2083)
#11 (#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10) (30380)
#12 (#3 AND #11) (689)

MEDLINE (OVID-WEB)

1 exp Hip Fractures/ (14374)
2 ((hip$ or femur$ or femoral$ or trochant$ or pertrochant$ or intertrochant$ or subtrochant$ or intracapsular$ or extracapsular$) adj4 fracture$).tw. (20530)
3 or/1-2 (24368)
4 (pin$1 or nail$ or screw$1 or plate$1 or arthroplast$ or fix$ or prosthes$).tw. (373702)
5 Internal Fixators/ or Bone Screws/ or Fracture Fixation, Internal/ or Bone Plates/ or Bone Nails/ (38946)
6 Arthroplasty/ Or Arthroplasty, Replacement, Hip/ (16673)
7 or/4-6 (392189)
8 and/3,7 (10200)
9 Randomized Controlled Trial.pt. (288019)
10 Controlled Clinical Trial.pt. (81031)
11 Randomized Controlled Trials/ (65860)
12 Random Allocation/ (67746)
13 Double Blind Method/ (105794)
14 Single Blind Method/ (13807)
15 or/9-14 (485594)
16 exp Animals/ not Humans/ (3456023)
17 15 not 16 (451438)
18 Clinical Trial.pt. (459990)
19 exp Clinical Trials as topic/ (226174)
20 (clinic$ adj25 trial$).tw. (171640)
21 ((singl$ or doubl$ or trebl$ or tripl$) adj25 (blind$ or mask$)).tw. (105960)
22 Placebos/ (28689)
23 placebo$.tw. (122017)
24 random$.tw. (476309)
25 Research Design/ (58709)
26 or/18-25 (1023571)
27 26 not 16 (947728)
28 27 not 17 (527927)
29 Comparative Study.pt. (1474572)

30 Evaluation Studies.pt. (131579)
31 Follow Up Studies/ (401470)
32 Prospective Studies/ (276848)
33 (control$ or prospectiv$ or volunteer$).tw. (2176203)
34 or/29-33 (3719846)
35 34 not 16 (2854342)
36 35 not (17 or 28) (2332392)
37 17 or 28 or 36 (3311757)
38 and/8,37 (3989)

EMBASE (OVID-WEB)

1 exp Hip Fracture/ (13988)
2 ((hip$ or femur$ or femoral$ or trochant$ or pertrochant$ or intertrochant$ or subtrochant$ or intracapsular$ or extracapsular$) adj4 fracture$).tw. (16123)
3 or/1-2 (20930)
4 (pin$1 or nail$ or screw$1 or plate$1 or arthroplast$ or fix$ or prosthes$).tw. (289999)
5 Bone Screws/ or Fracture Fixation/ or Bone Plate/ or Bone Nail/ or Intramedullary Nailing/ (21965)
6 Arthroplasty/ or Hip Arthroplasty/ (11271)
7 or/4-6 (297747)
8 and/3,7 (7706)
9 exp Randomized Controlled Trial/ (184888)
10 exp Double Blind Procedure/ (77062)
11 exp Single Blind Procedure/ (9242)
12 exp Crossover Procedure/ (22728)
13 Controlled Study/ (3133549)
14 or/9-13 (3153381)
15 ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed) adj3 (trial or study)).tw. (369503)
16 (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. (89643)
17 ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. (100047)
18 (cross?over$ or (cross adj1 over$)).tw. (42042)
19 ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. (100779)
20 or/15-19 (549553)
21 or/14,20 (3365913)
22 limit 21 to human (2014087)
23 and/8,22 (1856)

Appendix 2. Searches prior to 2000

Search activity
Electronic searching of MEDLINE up to August 1999 with the following search terms: (Gamma and nail) and (screw and (dynamic or compression or Ambi)).
Handsearches of the following journals from 1990 when the first reports of the use of the Gamma nail were published: Journal of Bone and Joint Surgery - American Volume, Journal of Bone and Joint Surgery - British Volume, Acta Orthopaedica Scandinavica, Journal of Trauma, Injury, Clinical Orthopaedics, Orthopaedic Clinics of North America, International Orthopaedics, and Journal of Royal College of Surgeons (Edinburgh).

(*Continued*)

Handsearching of conference abstracts from 1990 reported within the Journal of Bone and Joint Surgery - American Volume, Journal of Bone and Joint Surgery - British Volume, Acta Orthopaedica Scandinavica Supplementum, and Injury.

Appendix 3. Methodological quality assessment results (*see* Table 2 for criteria)

Gamma nail versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Adams 2001	3	1	1	1	1	1	1	1	1	1	1
Ahrengart 1994	2	1	0	1	1	0	0	0	1	0	1
Benum 1994	1	0	0	1	0	0	0	0	1	0	0
Bridle 1991	1	1	0	1	1	0	0	0	1	0	0
Butt 1995	0	1	0	1	0	0	0	0	0	1	0
Goldhagen 1994	0	1	0	1	0	0	1	0	1	1	0
Guyer 1991	0	0	0	0	0	1	0	0	0	0	0
Haynes 1996	0	1	0	1	0	0	0	0	1	1	0
Hoffman 1996	3	1	1	1	0	1	1	1	1	1	1
Kukla 1997	2	1	1	1	1	0	1	0	1	1	1

(*Continued*)

Kuwabara 1998	1	0	0	1	0	0	0	0	1	0	0
Leung 1992	0	0	0	0	0	0	0	0	1	1	1
Marques Lopez 2002	0	1	0	1	0	0	0	0	1	0	0
Michos 2001	1	0	0	0	0	0	0	0	0	0	0
Mott 1993	2	1	0	0	0	0	1	0	0	0	1
O'Brien 1995	3	1	0	1	0	0	1	0	0	0	1
Ovesen 2006	3	1	1	1	0	1	0	0	1	0	1
Pahlpatz 1993	1	0	0	0	0	0	0	0	1	0	0
Papasimos 2005	1	1	0	1	0	1	0	0	1	0	0
Park 1998	0	1	1	1	0	0	1	0	0	1	0
Radford 1993	1	0	0	1	1	0	0	0	1	0	0
Utrilla 2005	2	1	1	0	1	1	1	0	1	1	0
Intramedullary hip screw (IMHS) versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Baumgaertner 1998	3	1	0	0	0	1	1	0	1	1	1
Hardy 1998	0	1	1	1	0	1	1	1	1	1	0

(*Continued*)

Harrington 2002	2	1	0	1	0	1	1	1	1	1	1
Hoffmann 1999	3	1	1	1	0	1	1	0	0	1	0
Mehdi 2000	2	0	0	0	0	0	0	0	1	0	1
Proximal femoral nail (PFN) versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Pajarinen 2005	3	1	1	1	1	1	1	0	0	0	1
Papasimos 2005	1	1	0	1	0	1	0	0	1	0	0
Saudan 2002	2	1	1	1	1	1	1	0	1	1	1
Proximal femoral nail antirotation (PFNA) versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Zou 2009	1	1	0	0	0	1	1	0	1	0	0
Targon PF (proximal femoral) nail versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Giraud 2005	2	1	1	1	0	0	1	0	0	0	1
Long Holland nail versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**

(*Continued*)

Little 2008	2	1	1	1	0	1	1	0	1	1	0
Long Gamma nail versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Barton 2010	2	1	0	1	1	1	1	0	1	0	1
Mini-invasive static intramedullary nail versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Dujardin 2001	1	1	0	1	1	1	1	0	1	0	0
Kuntscher-Y nail versus sliding hip screw											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Davis 1988	3	1	0	1	0	0	1	0	0	1	1
Intramedullary nail (two types) versus the SHS											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Verettas 2010	0	1	0	1	0	1	1	0	0	1	1
Intramedullary nails (various types) versus Medoff sliding plate											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Ekstrom 2007	2	1	0	1	0	1	1	0	1	0	0
Miedel 2005	2	1	1	1	0	1	1	0	1	1	0
Gamma nail versus the percutaneous compression plate (PCCP)											

(*Continued*)

Study ID	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11
Varela-Egocheaga 2009	2	1	0	1	1	1	1	0	1	1	0
Intramedullary nails versus fixed (static) extramedullary plates for trochanteric fractures											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Pelet 2001	2	1	1	1	0	1	1	0	1	1	1
Sadowski 2002	2	1	1	1	1	1	1	0	1	1	1
Intramedullary nails versus fixed (static) extramedullary plates for subtrochanteric fractures											
Study ID	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**	**Item 7**	**Item 8**	**Item 9**	**Item 10**	**Item 11**
Lee 2007	0	1	0	0	1	1	1	0	1	0	0
Rahme 2007	1	1	0	1	0	0	1	0	1	0	0

WHAT'S NEW

Last assessed as up-to-date: 7 July 2010.

Date	Event	Description
3 August 2010	New search has been performed	For the seventh substantive update, which first appeared in Issue 9, 2010, the main changes were as follows. 1. The search for trials was updated to April 2010. 2. Risk of bias was assessed for sequence generation, allocation concealment and surgeons' experience with the devices. 3. There were seven newly included trials (Barton 2010; Lee 2007; Little 2008; Rahme 2007; Vareal-Egocheaga 2009; Verettas 2010; Zou 2009). Little 2008 was formerly Fer-

(*Continued*)

		nando 2006 in 'Studies awaiting classification' and Rahme 2007 was formerly Harris 2005 in 'Studies awaiting classification'. 4. Extra reference for a conference abstract for Giraud 2005 added. 5. Six new comparisons were added (Proximal femoral nail antirotation versus SHS; Long Gamma nail versus SHS; Holland nail versus SHS; Gamma nail versus the percutaneous compression plate (PCCP); Intramedullary nail (two types) versus the SHS; femoral nails versus condylar screw or blade plates for subtrochanteric fractures). 6. One newly identified study (Rafiq 2009) was added to 'Studies awaiting classification'. 7. Nine newly identified studies (Cao 2009; Hu 2006; Liu 2008; Nouisri 2006; Pan 2009; Saarenpaa 2009; Zhang 2009; Zhao 2009; Ziran 2009) were excluded. 8. Four more ongoing studies identified and added to ongoing studies (Matre 2009; Molnar; REGAIN; Schipper). 9. All studies presented with the analysis were ordered chronologically to clarify if changes were occurring over time. 10. The Discussion was restructured and revised. 11. Changes were made to the conclusions.
2 August 2010	New citation required and conclusions have changed	Changes were made to the conclusions reflecting the inclusion of further comparisons.

HISTORY

Protocol first published: Issue 2, 1995

Review first published: Issue 3, 1996

Date	Event	Description
1 April 2008	New search has been performed	Converted to new review format.
4 March 2008	New citation required and conclusions have changed	For the sixth substantive update, which first appeared in Issue 3, 2008, the main changes were as follows. 1. The search for trials was updated to June 2007. 2. Four newly identified studies (Ekstrom 2007; Giraud 2005; Ovesen 2006; Papasimos 2005) were included. 3. One new comparison was added (Targon PF nail versus SHS) and one category extended to include the PFN versus Medoff plate comparison. 4. One previously ongoing study (Khaleel) was moved

(*Continued*)

		to awaiting assessment and renamed Fernando 2006. 5. One newly identified study (Harris 2005) was added to awaiting assessment. 6. Five newly identified studies (Azzoni 2004; Bienkowski 2006; Kafer 2005; Klinger 2005; Tarantino 2005) were excluded. 7. Additional information and data for an already included trial were added (Mehdi 2000). 8. The 'Synopsis' was rewritten as a 'Plain language summary'; and other changes made to comply with format and methodological requirements. 9. There were no substantial changes made to the conclusions.
15 August 2005	New search has been performed	For the fifth substantive update, which first appeared in Issue 4, 2005, the main changes were as follows. 1. The search for trials was updated to June 2005. 2. The newly identified studies of Miedel 2005, Pajarinen 2005 and Utrilla 2005 were included. 3. Study of Mott 1993 moved from excluded to included on receipt of additional information. 4. Three newly identified studies (Bhatti 2004; Khan 2002; Schipper 2004) were excluded. 5. One newly identified study (Khaleel) is listed as an ongoing trial and two other studies (Ahmad; White) await assessment. 6. The length of the 'Abstract' was reduced and other format changes undertaken to comply with the Cochrane Style Guide (November 2004). Other changes, such as the consideration of the I-squared statistic were made to comply with the Cochrane Handbook for Systematic Reviews of Interventions (March 2005). 7. Graphical presentation of the results was revised and compressed to reduce the number of graphs. 8. There were no substantial changes made to the conclusions.
1 November 2003	New search has been performed	For the fourth substantive update, which first appeared in Issue 1, 2004, the main changes were as follows. 1. The update of the search for trials to May 2003. 2. Newly identified study of Marques Lopez 2002 included. 3. Though a further report of Ahrengart 1994 was identified giving results for more patients we kept the results from the previous report, pending clarification. 4. Three newly identified studies (Hardy 2003; Herrera 2002; Nuber 2003) were excluded. 5. The studies of Davidson 1996 and Prinz 1996 were

(*Continued)*

		moved from 'Awaiting assessment' to excluded. 6. Study of Moran 2000 moved from ongoing to excluded. 7. Reference to letter on study of Hardy 1998 added. 8. Details of newly identified ongoing study (Parker) added.
1 August 2002	New search has been performed	For the third substantive update, which first appeared in Issue 4, 2002, the main changes were as follows. 1. The update of the search for trials to August 2002. 2. Inclusion of newly identified study (Pelet 2001) comparing the Gamma nail with a blade plate. 3. Exclusion of another newly identified study (Dicicco 2000). 4. Incorporation of further details and results of three already included trials (Harrington 2002; Sadowski 2002; Saudan 2002), previously Harrington 1999, Saudan 2001b and Saudan 2001a respectively, obtained from newly published full reports of these trials. 5. Some restructuring of the text and tables to give emphasis on overall results of short femoral nails and lessen the emphasis on the outdated Kuntscher-Y nail. 6. Some adjustments to the 'Conclusions' but no substantive changes in implications.
1 November 2001	New search has been performed	For the second substantive update, which first appeared in Issue 1, 2002, the main changes were as follows. 1. The update of the search for trials to August 2001. 2. The inclusion of three new Gamma nail trials (Adams 2001; Kuwabara 1998; Michos 2001) and three new intermedullary hip screw trials (Harrington 1999; Hoffmann 1999; Mehdi 2000). 3. Two Gamma nail studies (Hogh 1992; Mott 1993) previously in studies awaiting assessment are now excluded as no further information has been forthcoming. 4. The inclusion of two new comparisons, each represented by one study: proximal femoral nail versus the sliding hip screw (Saudan 2001a) and proximal femoral nail versus the dynamic condylar screw (Saudan 2001b) . 5. The inclusion of one trial on a mini-invasive nail (Dujardin 2001). 6. Peto odds ratios changed to relative risks in accordance with Cochrane Review Group requirements. 7. The addition of a new outcome, 'All technical complications of fixation' and the clarification of the outcome: 'operative fracture'. 8. Pooling of the results for key outcomes for three of

(*Continued)*

		the short proximal femoral nails (Gamma, IMHS and the PFN) versus the sliding hip screw. 9. Addition of a 'Synopsis'.
1 February 1999	Amended	The first substantive update, appearing in Issue 2, 1999, involved an expansion of the original review, "Gamma nail versus sliding hip screw for extracapsular hip fractures", to include other cephalocondylic nails. Four more studies on the Gamma nail (Haynes 1996; Kukla 1997; Pahlpatz 1993; Park 1998), and two studies on the intramedullary hip screw (Baumgaertner 1998; Hardy 1998) were included.

CONTRIBUTIONS OF AUTHORS

Martyn Parker initiated and designed the review, usually contacted trialists for further information and compiled the first drafts of all versions. Helen Handoll located the review studies for most versions, occasionally contacted trialists for further information, always checked data entry and critically rewrote all drafts for all versions. All other tasks, including independent data extraction and quality assessment, were shared. Martyn Parker is the guarantor of the review.

DECLARATIONS OF INTEREST

Martyn Parker has received and may continue to receive financial payment from manufacturing companies of orthopaedic implants for attending meeting organised by these companies and for advising on the design and use of hip fracture implants. Helen Handoll has no connection with any manufacturing company.

SOURCES OF SUPPORT

Internal sources

- University of Teesside, Middlesbrough, UK.
- Peterborough and Stamford Hospitals NHS Foundation Trust, Peterborough, UK.

External sources

- Department of Health (England) Incentive Scheme, UK.
- National Institute for Health Research, UK.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

In the update of the review (2010) we made two key changes to Methods.

1. The outcome "all technical complications of fixation" is no longer presented. This reflected concerns voiced by one editor regarding potential unit of analysis problems, where some participants may have experienced more than one of the major complications of fracture healing, and the general problems of composite outcomes. It is possible that, after further checks of the data, we may reintroduce a similar outcome measure to account for major complications of fracture healing that generally require revision surgery or a change of surgical procedure during the primary operation, such as using a longer nail, but where a reoperation was not performed.

2. Three aspects of risk of bias were assessed and reported: sequence generation, allocation concealment and surgeons' experience with the devices.

INDEX TERMS

Medical Subject Headings (MeSH)

*Bone Nails; *Bone Screws; Fracture Fixation, Internal [adverse effects; *instrumentation]; Fracture Fixation, Intramedullary [adverse effects; instrumentation]; Hip Fractures [mortality; *surgery]; Randomized Controlled Trials as Topic

MeSH check words

Adult; Humans